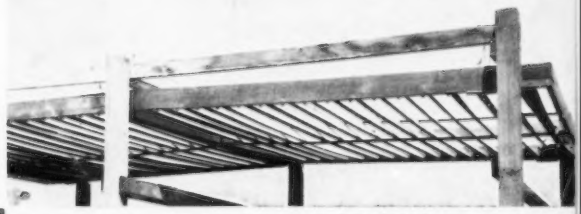
OCTOBER 1957

Agricultural Engineering

The Journal of the American Society of Agricultural Engineers

Impeller Blade Shape Affects Forage Blower Performance | 722

"Cold Spots" in the Sky Help Cool Livestock | 726



Preparing Land for Mechanization in the Southeast | 730

Device Isolates Radiant Heat for Animal Heat Transfer Studies | 734

Design Rain — Aid in Erosion Control Studies | 740

Model 200 SPREADER

Models 44, 45, 46 MOWERS

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Models 601 and 800 FORAGE HARVESTERS

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"Time-table Performance" with "Time-rated Machinery" offers special advantages. It also means close teamwork with the implements used, so each is ready for action in turn. Each is synchronized to fit into modern high-production farming schedules.

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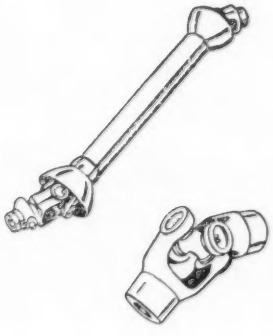
Implement builders, dealers and farmer-users know they can count on Blood Brothers Drive Lines. *And that makes any implement easier to sell.* Write or call for further information—we'll gladly assist you.



FOR FARM IMPLEMENTS, MORE BLOOD BROTHERS UNIVERSAL JOINTS ARE USED THAN ALL OTHER MAKES COMBINED

TAKES POWER AROUND CORNERS

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MACHINE DIVISION
ROCKWELL SPRING AND AXLE COMPANY
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why Crucible *LaBelle* discs stay sharp longer

Sharp edges mean better discing performance. And the secret of a sharp, long-lasting edge is in the *steel.*

Crucible LaBelle discs are the only ones prescription-made by *steelmen* to the right combination of toughness and hardness. And they are tempered to resist damage by rocks or roots in the field.

On new equipment – or for replacements – choose LaBelle discs. They're made for all makes of plows and harrows, and for all soil conditions. *Crucible Steel Company of America, The Oliver Building, Mellon Square, Pittsburgh 22, Pennsylvania.*

A Massey-Harris MH60 Hydramic Control Disc Harrow, factory-equipped with Crucible LaBelle discs.

CRUCIBLE first name in special purpose steels

Crucible Steel Company of America

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For more fac.s circle No. 3 on reply card

Agricultural Engineering

Established 1920

CONTENTS • OCTOBER, 1957 • Vol. 38, No. 10

Report to Readers 707

Agricultural Outlook 721

Impeller Blade Shape Affects Forage Blower Performance . 722
J. P. Raney and J. B. Liljedahl

"Cold Spots" in the Sky Help Cool Livestock 726
C. F. Kelly, T. E. Bond and N. R. Ittner

Preparing Land for Mechanization in the Southeast . . 730
T. E. Corley, J. O. Helms, F. A. Kummer and C. M. Stokes

Device Isolates Radiant Heat for Animal Heat Transfer Studies 734
R. E. Stewart

Imagineering the Next 50 Years 736
Charles E. Ball

Design Rain—Aid in Erosion Control Studies 740
D. B. Krimgold and Ami Shahori

News Section 744

Technical Paper Abstracts 747

New Products 748

Manufacturers' Literature 758

Research Notes 772

Index to Advertisers 774

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Power Executive Advanced

INDEED a credit to the agricultural engineering profession, is the recent announcement that E. C. "Pap" Easter, Fellow of ASAE, has been promoted to executive vice-president of the Alabama Power Company. It tells the story, once again, of the advancement of an agricultural engineer to a top level executive position.

In 1924, while employed as an agricultural engineer by Alabama Polytechnic Institute, Mr. Easter was given the task of working with the Alabama Power Company to determine profitable farm applications of electricity. He joined the Company in 1927 as chief agricultural engineer, and in 1933 was made manager of the rural and towns division. He devoted his time to the expansion of rural electrification throughout Alabama and had general supervision over the acquisition of towns, the developing of rate structures, and the handling of matters pertaining to the various regulatory commissions. Under Mr. Easter's direction the Alabama Power Company became a leader in the field of rural electrification. In March of 1949 he was advanced to sales manager and in October of that year was made vice-president in charge of sales.

E. C. EASTER

Mr. Easter was born on a farm near Coxey, Ala., and attended rural public schools in Limestone County. Pap graduated from the Alabama Polytechnic Institute in 1921 with a B.S. degree in agricultural engineering and received an M.S. degree in 1923. Until 1927 he was employed by API as an agricultural engineer.

He is one of the pioneer members of the National Committee on the Relation of Electricity to Agriculture and was the first chairman of the Alabama Section of ASAE. He has served as counselor for the National Farm Electrification Conference, chairman of the farm section of the Edison Electric Institute, chairman of the Heat Pump Committee of the Southeastern Electric Exchange, and chairman of the sales section of the Southeastern Electric Exchange.

In 1953 he was awarded the Honorary State Farmer Degree by the Alabama Association of Future Farmers of America, and in the same year was presented a certificate of appreciation by the Alabama Section of ASAE for his interest and leadership in the activities of the Section.

October—Membership Month

PROFESSIONAL organization mobilizes professional talent to improve the professsion's capacity to serve. This accrues to the mutual advantage of those served, the profession, and its individual members. It supplements and coordinates the mobilization and development of talent by industry and public service agencies.

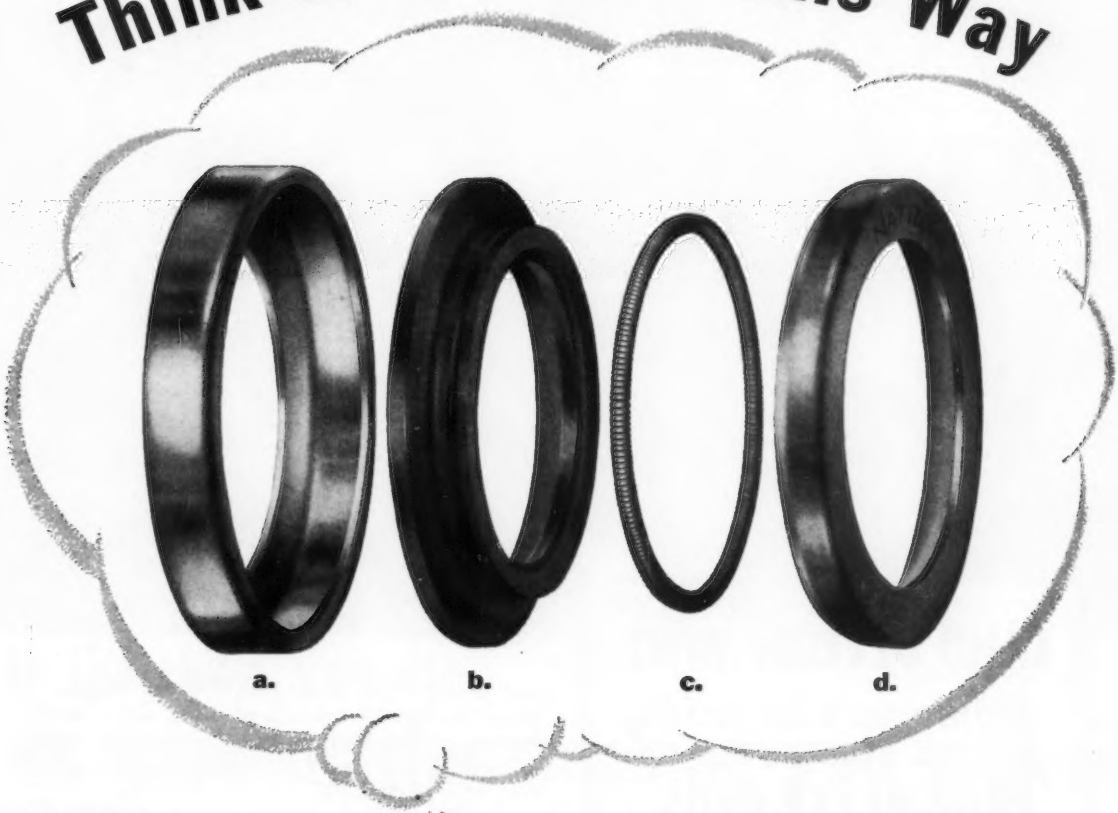
To render maximum service, a professional organization must maintain a continuing effort to enroll all qualified persons practicing the profession. Organization strength and services are reinforced through adequate representation of all elements of the profession by qualified individuals. Services to members also will increase with increases in membership.

October has been designated as "Membership Month" by ASAE. October represents the beginning of the year's activities for most ASAE sections. Applications received

(Continued on page 725)

When you design-in seals

Think of Oil Seals This Way



a. Outer Case

Formed to extreme close tolerance of heavy gauge steel with sufficient structural strength to maintain precision dimension.

b. Sealing Lip

Properly prescribed material either compounded or processed for application conditions of temperature and eccentricities. Precisely molded for correct shaft interference, low torque and positive sealing.

c. Tension Spring

Carefully engineered as to metallurgy, heat treatment and coil diameter to provide uniform compressive force on the sealing element.

d. Inner Case

Strengthens, protects; sturdy gauge steel formed to close tolerances.

4227

A good oil seal is a carefully engineered, precision manufactured assembly of carefully engineered, precision manufactured components. Each part must be exactly right *for the given application* or the seal will not function properly.

You avoid dangers of costly retooling, remanufacture or premature replacement when seals are correctly specified during your product's design stage. Each sealing application is different; many designers use National's field engineering service to be sure correct—and latest—oil seals are used.

Why "do it yourself?" Call the National Seal field engineer now. His service involves no obligation.

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LAND DEVELOPMENT
from start to finish

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PRIESMEYER BROS.

From heavy stands of trees and brush to seedbed – that's the kind of service Priesmeyer Bros., El Campo, Texas, are prepared to offer their customers. It pays off in more hours of work, a well-rounded line-up of equipment, more satisfied customers and more profits for farmer and contractor.

Priesmeyer Bros. have two CAT* D8 Tractors and a D6, a Fleco Rock Rake, for pushing, raking and piling, a 10′ Rome Disk Plowing Harrow, a plane for forming the cleared fields, and a border builder. In illustration above, Priesmeyer Bros.' D6 and D8 are shown clearing and stacking elm, oak, on a custom job.

They credit their success, in part, to their Cat Diesel Tractors. Arthur Priesmeyer, co-owner, says: "We started off with a D8 two years ago and have gone 2200 service hours without trouble. Now, with our new D8, we're ready for all comers. We take care of our farm in our spare time."

Headquarters for land development in any community is your Caterpillar Dealer. He knows what earthmoving equipment can do, and can help conservationists plan their equipment requirements. Further, he has the world's most complete line of earthmoving equipment built by one manufacturer, sold and serviced by one dealer organization. See him soon.

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

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Promote conservation and small watersheds in your community. Free booklet "Stop your floods . . ." will help you do it—order enough for your friends.

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CATERPILLAR*

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CONSERVATION PARTNERS
CATERPILLAR DEALERS—
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The good name of your machine is LINK-BELT's first consideration . . . TRADE MARK . . . and quality should be your first consideration in the chain you buy

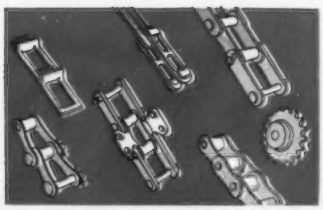
NEW IDEA No. 300 2-row pull type corn picker which uses Link-Belt "AG" roller chain, steel detachable Link-Belt and "RC" couplings.

Is the chain you use as good as the machine you make?

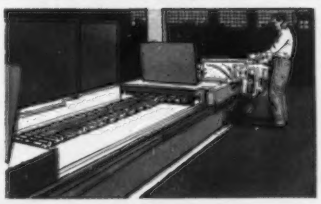
Here's how LINK-BELT matches drive and conveying chain to the field requirements of your equipment

THE Link-Belt double-arrow trademark on chain means that each link in every length conforms to rigid quality and uniformity specifications. And it's your assurance that the drive or conveyor chain specified will maintain rated performance and efficiency on your machine.

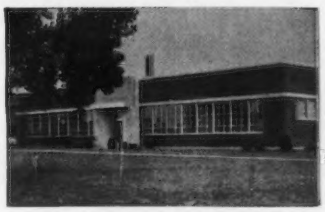
From the world's largest chain plant, Link-Belt offers you the economies of mass-production . . . represents a ready source for all your chain and sprocket needs. For prompt service, call your nearby Link-Belt office. 14,614



COMPLETE LINE of agricultural chains, sprocket wheels and attachments permits cost-saving specialization — offers right chain for all conveyor and drive needs.



ACCURATE MANUFACTURE AND CONTINUOUS INSPECTION with modern, specialized machines allow economies of large-scale production. Extensive facilities provide ample capacity to meet your production schedules.



LABORATORY CONTROL assures you that each chain meets rigid uniformity specifications. Our modern laboratory continuously explores new refinements to increase chain life.

LINK-BELT

CHAINS AND SPROCKETS

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants, Sales Offices, Stock Carrying Factory Branch Stores and Distributors in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville (Sydney), N.S.W.; South Africa, Springs. Representatives Throughout the World.

Special Dayton Cog-Belts*

Perform 'Human' Tasks on TAWCO Radish Combine

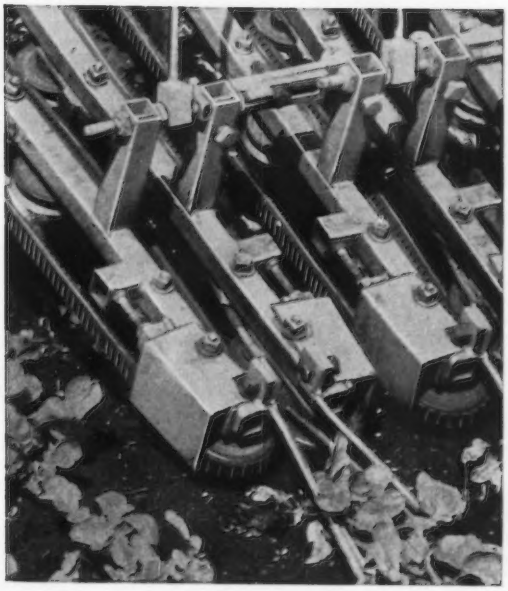
Dayton Agricultural Engineers—working with designers on the Tawco Implement Company's Radish Combine—put V-Belts to an unusual task on this remarkable implement.

The special V-Belt they designed—a long Double Cog-Belt* featuring an extra outer layer of very soft rubber—is used to pick radishes and convey them rearward to a topping assembly.

This extraordinarily efficient Radish Combine, introduced by Tawco over two years ago, has replaced hand picking and harvesting and, for the first time, makes *complete* mechanized harvesting practical. Depending on the size of the radishes, the Tawco Combine—operated by one man—harvests and tops 10 to 15 tons a day.

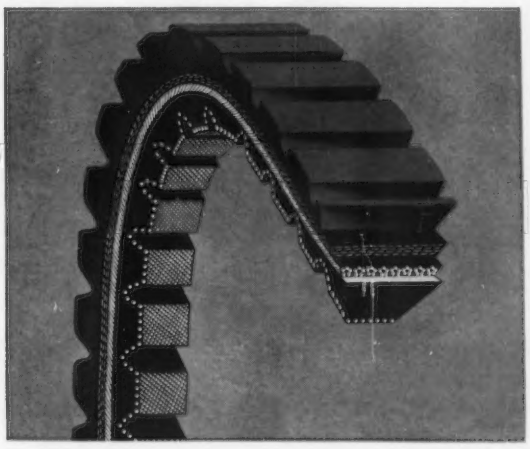
The unique soft-rubber outer section of the specially-built Dayton Double Cog-Belt permits the Combine to perform 100% harvesting with a deft "human touch," without cutting or bruising the radishes. The radish top is grasped between pairs of moving V-Belts, gently lifted from the soil and conveyed to the topping assembly. The inner section of each belt is of conventional Dayton cog construction—noted for easy flexing around sub-diameter pulleys and the ability to clear sheaves of field mud and debris. The success of this special V-Belt design has been proved by field experience with over 200 Tawco Radish Combines.

This is an interesting example of Dayton Field Engineers working hand-in-hand with implement manufacturers in creating efficient agricultural machinery. Consult the Dayton Agricultural Engineer on your drive designs; Dayton's long experience in V-Belt development is at your service. Write The Dayton Rubber Company, Agricultural O.E.M. Division, Dayton 1, Ohio.



When harvesting, each pair of Dayton Double Cog-Belts must grip the top of the radish, lift it from the soil and convey it upwards to the topping mechanism. Soft rubber is used on the conveyor side of the belt to avoid nipping the tender leaves while conventional Cog construction is used on the drive side for maximum durability.

Especially designed for use with small diameter pulleys, Dayton Double Cog-Belts are noted for their ability to clear mud and debris from the sheave groove. Double Cog-Belts are available in standard and special constructions and are generally recommended for use in heavy duty variable speed drives.



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Dayton Rubber

WORLD'S LARGEST MANUFACTURER OF V-BELTS

Agricultural Sales Engineers in Atlanta, Chicago, Cleveland, Dallas, Dayton, Moline, New York, San Francisco and St. Louis

THE HEAVIER THE LOAD...

the more you need HYATTS . . . because size for size, no other kind of bearing made can equal straight cylindrical roller bearings for sheer load-carrying capacity in heavy-duty service. That's why John Deere uses HYATTS in this combine.

THE HIGHER THE SPEED...

the more you need HYATTS . . . because their uncompromising combination of superior steels, precision manufacture and scrupulous control of internal clearances assures smoother performance in high-speed applications like the famed *Firebird II*.

THE MORE YOU NEED *Cylindrical* HY-ROLL BEARINGS

Today, with loads and speeds trending upward and space often at a premium, many a manufacturer is finding that bearings of limited capacity are no longer good enough. If you are seeking ways to squeeze better life/load ratings into smaller housings, HYATT has the answer. Shouldered-race HYATT HY-ROLLS will not only solve your radial load problem but take a surprising amount of thrust, too. Ask your nearest HYATT Sales Engineer for recommendations—he's a mighty good man to know! Hyatt Bearings Division, General Motors Corporation, Harrison, N.J.; Pittsburgh; Detroit; Chicago; and Oakland, California.

THE RECOGNIZED LEADER IN CYLINDRICAL BEARINGS

HYATT HY-ROLL BEARINGS

THE "WORKHORSES" OF MODERN INDUSTRY

GM GENERAL MOTORS

Report to Readers . . .

FARM WAGE RATES CLIMBING FASTER THAN MACHINE COSTS

Farm wage rates in the United States have increased almost three times as rapidly as have farm implement costs. This is the keynote of a report issued recently by two University of Minnesota extension agricultural economists. They say farm wage rates have gone up more than 300 percent since 1940, in comparison with a 76 percent increase for motor power and 130 percent for implement costs. . . . Fact is that wage-rate increases have compelled many farmers to substitute labor-saving machinery for hired labor. As an indication of this, while farm wage rates in the United States have tripled since 1940, total wages paid for farm labor have only doubled. . . . This trend is likely to last so long as the general economy can continue to support a high employment level.

SOLAR-POWERED FENCE CHARGER IN ADVANCED STAGE OF DEVELOPMENT

An electric fence minus connection to an electric power line would receive a thumping welcome down on the farm. Such a possibility appears to be in the offing from the work of engineers of Purdue University's agricultural engineering department. . . . Radiant energy from the sun is collected by silicon solar cells which convert it directly into electrical energy for operation of the fence charger. These solar cells also charge nickel-cadmium storage cells which in turn operate the charger when the sun is not shining. . . . High manufacturing cost of the cells constitutes the principal deterrent just now for putting this new charger on the market, but it is understood that progress is being made toward lowering this cost to the point where farmers can afford to buy it.

A TREASURE CHEST OF ENGINEERING DATA RELATED TO FARM EQUIPMENT

We have just had the privilege of reviewing one section - on crop production equipment - of a new engineering handbook now headed towards publication. The principal author of this handbook, which incidentally bears his name, is a well-known farm-equipment-industry engineer, who has drawn widely on the best technological knowledge and practical experience of other industry engineers, as well as of engineers in public-service employ, in the preparation of this work. . . . The subject matter of this handbook will include the entire range of engineering as related to agriculture. The text is well prepared and is in a form to facilitate convenient reference. The book is being published by one of this country's leading publishers of engineering reference books. As yet the publication date has not been announced, but this journal will have the information as soon as it is released. . . . Publication of this new handbook will bring to realization a long-cherished dream of many readers of AGRICULTURAL ENGINEERING. For thirty years, more or less, members of ASAE have frequently given voice to a keen desire for a handbook built to their specifications - a handy, concise, authoritative reference source of data on engineering applications in the agricultural industry. The editors and publisher of the new handbook believe it will meet that need. . . . In perusing the manuscript of the section of the handbook referred to above, this writer was specially impressed with the host of references to engineering data originally published in AGRICULTURAL ENGINEERING - about 80 percent would seem a conservative estimate. This fact need not, however, occasion surprise inasmuch as AGRICULTURAL ENGINEERING has been and still is the only periodical publication - in North America, that is - whose feature-article section is devoted practically exclusively to subject matter on engineering in agriculture at the professional level.

FARM GATE LIES DOWN AND LETS TRACTOR RUN OVER IT

It's a grid gate, of two gate sections inclined towards each other and hinged at ground level to a steel-base frame. When the front tractor wheels touch the lower bar of the nearest gate section, it folds down flat on the ground, taking the other section with it, so the tractor can pass over the top. As soon as the tractor wheels roll off the gate sections, counterweights raise them to their normal closed position. The two sections can be locked in a flat position for driving animals through the opening. . . . Built by a British firm (Tansley), this product offers users welcome release from the nightmare of the all-too-common cumbersome farm gate.

APPROACHING AUTOMATION AS INTEGRATED MECHANIZATION

It is with that approach that the editors of "General Electric Review," in a staff report in that publication's September, 1957, issue, discuss the subject of automation, particularly as applied to factory production. Their report makes this significant statement: "Automation should be regarded as a gradual, evolutionary process. Its most important effect will not be on the level of employment but rather on the qualifications and functions of employees. No one should entertain the slightest doubts about automation: it can no more create unemployment than could mechanization. History proves that increasing technology creates new products and opens new fields so rapidly that the demand for workers increases steadily." . . . The report asserts that production in this country must increase about 40 percent in the next 10 years, while the available work force in that period will increase only about 14 percent. This means that factories in the future will be hard pressed for man power and that automation appears to be a primary solution. Therefore, in the widest possible use of new and better mechanized equipment can a full measure of employment and a higher level of living be achieved.

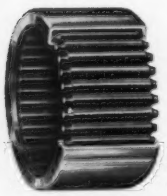
TRACTOR-POWERED POTATO COMBINE SPEEDS SPUDS OUT OF THE GROUND

It is called a "combine" - for one reason, because it combines a tractor with a potato harvester. The rear wheels and front axle (and wheels) are removed from a Case tractor and are used to carry a Dahlman potato harvester. The remainder (or power plant) of the tractor is then mounted on the steel frame of the harvester to power the "combine." When not used for potato harvesting, the tractor may be reassembled for regular farm use. . . . When conditions are favorable, the tractor operator handles the entire job of lifting two rows of potatoes at a time out of the ground and into a truck driven alongside the combine. . . . The machine is provided with a gallery where one or more men can be stationed under unfavorable conditions to remove clods or stones from the potatoes as they move along a cross-conveyor. . . . This potato combine is significant of the current trend of expanding mechanization in agriculture.

NEW RADIOACTIVITY INSTRUMENT SPEEDS TESTING OF SOIL MOISTURE AND DENSITY

A simpler and faster way to determine the moisture content and density of any soil is claimed for a new radioactivity device announced by a Chicago manufacturer. This will be of special interest to engineers who have occasional or frequent need to make soil moisture and density determinations. . . . Main advantages of the new system are simplicity of application and speed of measurement. Both moisture and density can be measured, even by a non-technical operator, in less than one-tenth the time for other systems. . . . Another advantage of the device is that it makes possible continuous studies of the same soil volume over an extended period of time by means of an access tube driven into the ground where it remains for subsequent determinations.

Torrington DC Needle Bearings and new Torrington Needle Thrust Bearings are used in the Case Model 425 Corn Picker for low friction, high capacity, efficient lubrication and long service life.



Needle Bearings

Needle Thrust Bearings

Reducing Wear and Care in Case Corn Picker

The J. I. Case Company makes extensive use of Torrington Needle and Needle Thrust Bearings to reduce wear and insure dependable operation of vital parts in the Model 425 Two-Row Mounted Corn Picker.

Eleven Torrington DC Needle Bearings and ten Needle Thrust Bearings are used in snapping rolls, gathering chain boxes, recleaner main drive and reverse idler. Efficient anti-friction operation and high radial and thrust load capacity are provided at low unit cost. Torrington Needle Bearings contribute to simplified design and easy assembly, and their design extends the interval of relubrication.

These advantages are typical of the contributions Torrington Needle Bearings are making to reduce wear and care in all kinds of farm equipment. To secure the economy and efficiency of Torrington Needle Bearings in your equipment, call on your Torrington representative for application assistance. **The Torrington Company, Torrington, Conn.—and South Bend 21, Ind.**

TORRINGTON BEARINGS

District Offices and Distributors in Principal Cities of United States and Canada

NEEDLE • SPHERICAL ROLLER • TAPERED ROLLER • CYLINDRICAL ROLLER • BALL • NEEDLE ROLLERS • THRUST

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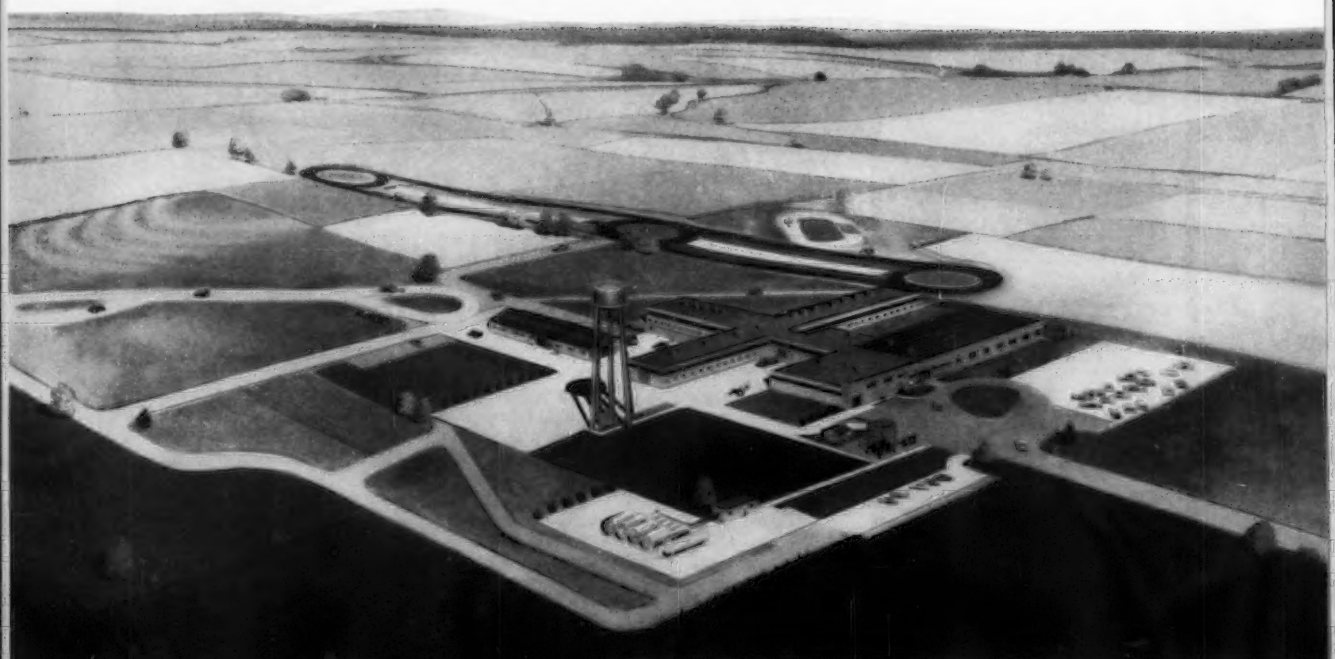
John Deere and



***This new John Deere Engineering and Research Center** near Waterloo, Iowa provides modern facilities for all phases of tractor research and development work of both the John Deere Waterloo Tractor Works and the John Deere Dubuque Tractor Works.*

 For more facts circle No. 16 on reply card

Research Engineering Center

Keeps Tractor Quality At Its Highest!

Quality is a precious commodity in any organization, and particularly so in the farm equipment industry. From quality stem the faith and subscription that make one manufacturer's product more acceptable than another's. Tractors are a good example. At John Deere, tractor quality is guarded with a vengeance. The words of the blacksmith, spoken more than a century ago, still ring loud and clear—"I'll never put my name on an implement that hasn't in it the best that is in me."

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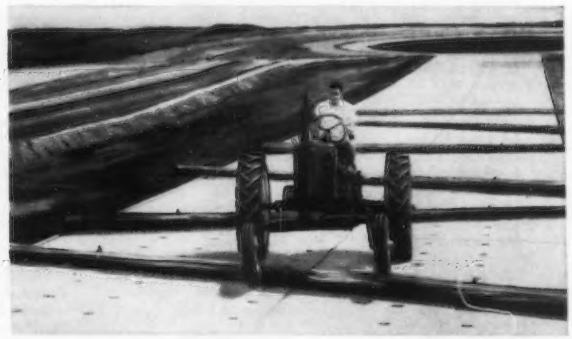

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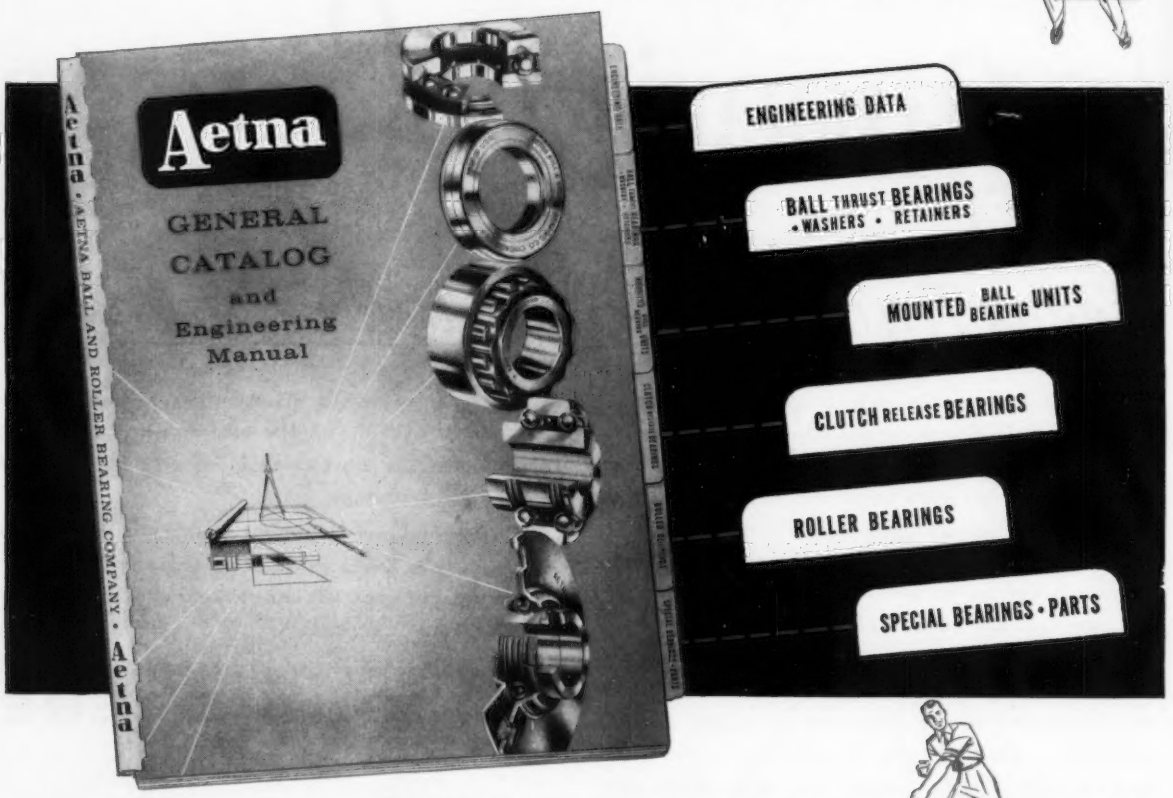
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Expressed in dollars and cents, this attitude at Purolator has come to mean that it costs less to buy a Purolator filter than to pay for the consequences of operating without one. These consequences may very well be an inferior product, a product that wears rapidly, or even a product that fails to perform at all.

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Equal spacing of rollers means uniform distribution of load. The result is the elimination of destructive "pulse" and vibration.

Cutaway view of Rollway Tru-Rol® segmented-retainer roller bearing . . . one of three distinct types of Tru-Rol bearings available.

Moreover, separators are of deep section, formed to the curve of the rollers, giving true axial alignment, smooth-surface contact and an even lubrication film on each roller.

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Retainer Construction

☐ Is the retainer strong enough to withstand shock loads and sudden reversals?

(A Rollway segmented-type steel retainer, such as that illustrated, is the strongest, most durable available in commercial grade bearings.)

Roller Spacing

☐ Are all rollers equally separated, or do some rub against each other in opposed-motion friction?

☐ Are rollers distributed evenly to prevent "pulse" and vibration?

Roller Construction

☐ Are the rollers crowned for optimum load distribution?

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Dual fertilizer applicator made by Dempster Mill Manufacturing Co., Beatrice, Neb., applies wet and dry fertilizer simultaneously. Metering pump for liquid fertilizer is located on the frame just ahead of the tank.

Ni-Resist iron meets dual need in liquid fertilizer pumps: resists corrosion and has good castability

The pump that meters liquid fertilizers in this new applicator could have been a real headache for Dempster Mill Manufacturing Company.

Why? Because many of its parts require metal with dual properties—metal that has top-notch resistance to corrosive fertilizers, yet metal that is easily cast.

Ni-Resist* high nickel iron fills the bill on both counts

First, it has excellent corrosion resistance, stands up to a variety of chemical fertilizers—phosphoric acid, liquid ammonia, ammonium nitrate. There's no flaking off of scale fragments to clog lines and valves.

Second, it has excellent castability. Shapes like pump bodies, heads, and liners can be formed easily and economically with Ni-Resist. There's a minimum of machining, a minimum of scrap.

Components exposed to corrosives are almost always improved when cast in Ni-Resist high nickel iron. Experience shows that it adds years to the service life of casings, pump bodies and other hard-to-fabricate shapes.

Informative 64-page booklet now available... *Engineering Properties and Applications of Ni-Resist* gives a wealth of valuable information about Ni-Resist iron. Compositions, corrosion resistance in various media, design and fabrication factors—these are just a few of the subjects discussed. Write us for your copy.

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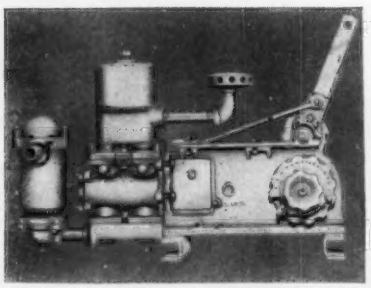

Corrosion-resisting liquid fertilizer pump has cast parts of Ni-Resist high nickel iron. Other parts are machined from standard forms of nickel-containing Type 316 stainless steel.

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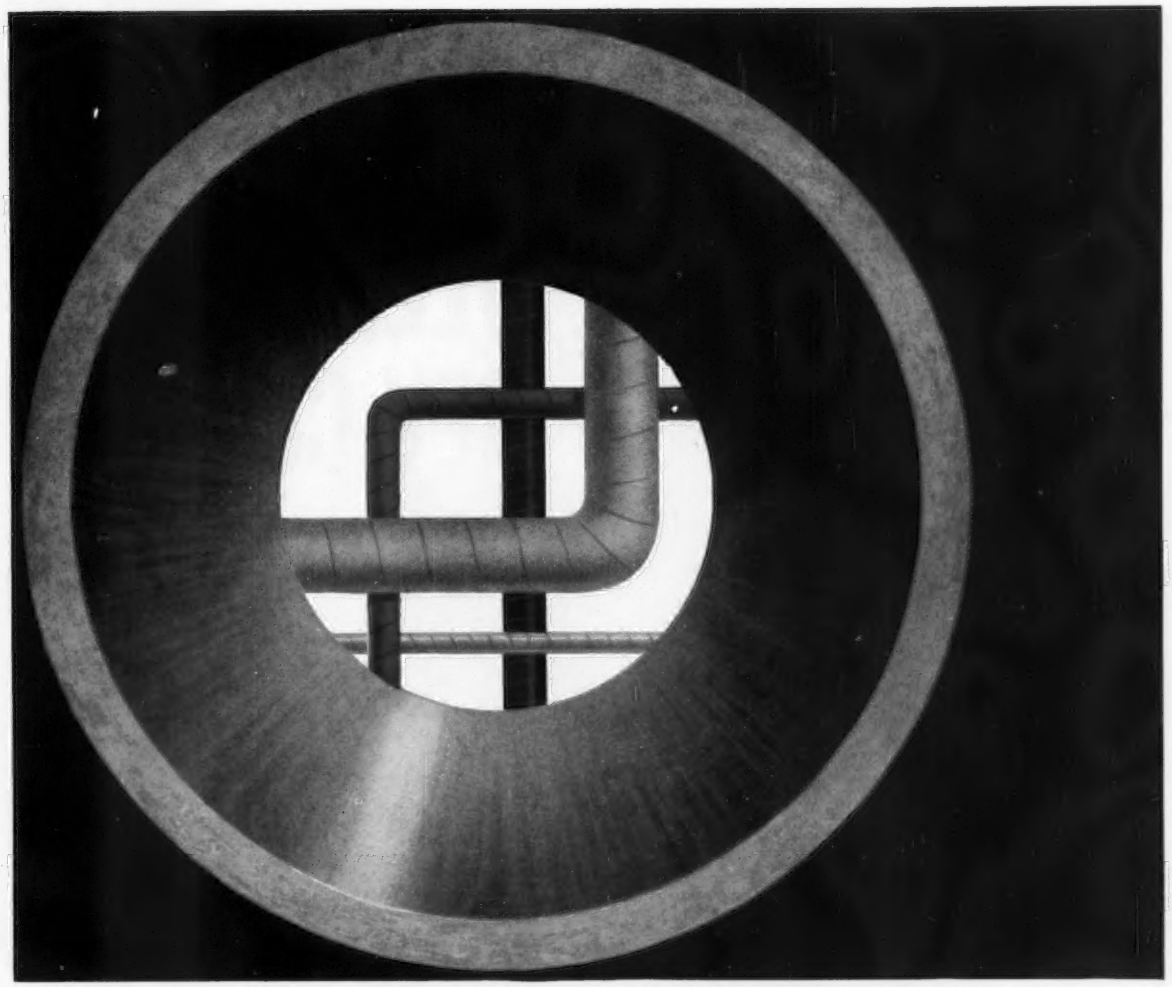

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Enjay Butyl is the super-durable rubber with *outstanding* resistance to aging • abrasion • tear • chipping • cracking • ozone and corona • chemicals • gases • heat • cold • sunlight • moisture.

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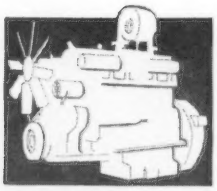

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Rev-Counter especially designed for installation in user's housing.

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Veeder-Root Rev-Counters are available with *tachometer take-off* . . . and may be geared to your own engine requirements. Count on Veeder-Root for any assistance you need in designing these Rev-Counters into your product. Write:

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Technical-ities

By John S. Davey

Fastener coatings

Salt spray testing of various metallic coatings used on fasteners doesn't always give a true picture. In actual service, accelerated test results are not always borne out.

Reason: The tests favor the coatings which can endure continuous moisture and salt atmospheres, whereas some do better under the normal intermittent dry and wet conditions of weathering.

Experience has developed a "scale" of suitability of various coatings for fastener protection.

FOR RUST PROTECTION

Hot galvanizing offers greatest endurance under most conditions. It falls short on highly stressed fasteners.

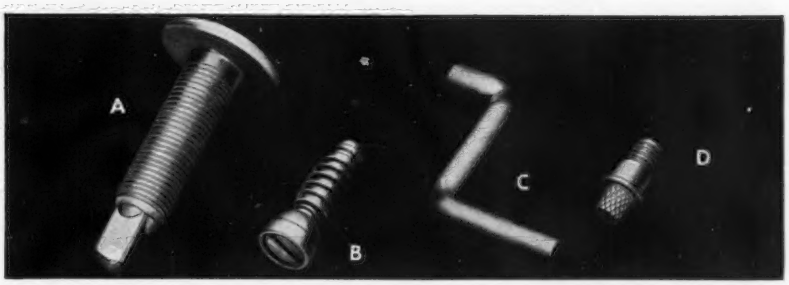
Electrodeposited zinc is next most practical – providing good appearance, controlled tolerance at threads, and ability to take high bolt tensions.

Cadmium plate stands out where salt atmospheres predominate. Not suitable for contact with edibles, it is ruled out for many appliances.

For general applications, the rust prevention of black oxide coatings proves satisfactory. Phosphate coatings, too, offer some degree of protection, but not under severe conditions.

Chromium, plated over copper, should be considered more for its appearance on fasteners rather than protection.

Cold heading creates quality parts the low cost way



No value analysis of product components is really complete without exploring what cold heading machines can do to cut costs. Some examples:

A. ELIMINATE EXTRA OPERATIONS. Leveling screw, formerly made by riveting flat disc to set screw, now emerges as a stronger, single piece from a cold header.

B. ONE PIECE BETTER THAN TWO. Cold headed hose clamp screw has integral flange which, after head is slotted, is forced up to form screwdriver shield. Before, piece was in two parts . . . with screw made on screw machine, and the shield a stamping fitted around head during assembly.

C. FASTER THAN FORGING. Shifter lever is bent into double "L" automatically in bolt header . . . replacing 2-stage forging operation. The header does it at high speed from continuous rod.

D. METAL *FLOWS* TO SHAPE—NO WASTE. No longer cut on screw machine, insert screw for plastic parts costs 40% less. Cold header uses just the amount of metal required. The threading and knurling, too, are done automatically at high speed.

Metal forced to cold flow into shape results not only in savings but also in stronger parts. With uncut flow lines, the piece is better able to withstand stress concentrations.

For an expert opinion on parts you now use, check with Russell, Burdsall & Ward Bolt and Nut Company, Port Chester, New York.

Plants at: Port Chester, N. Y.; Coraopolis, Pa.; Rock Falls, Ill.; Los Angeles, Calif. Additional sales offices at: Ardmore (Phila.), Pa.; Pittsburgh; Detroit; Chicago; Dallas; San Francisco.

12-point fasteners cut wrench clearance space

Double hex RB&W bolts and nuts measure smaller across their points than single hex fasteners. Used with an *external* socket wrench, they permit optimum driving torque to be applied.

Thus, while permitting design of more compact assemblies, these fasteners also assure proper preloading for stronger connections.

Available with plain flange, or SPIN-LOCK design which incorporates teeth that embed upon tightening and resist loosening under vibration or temperature changes.

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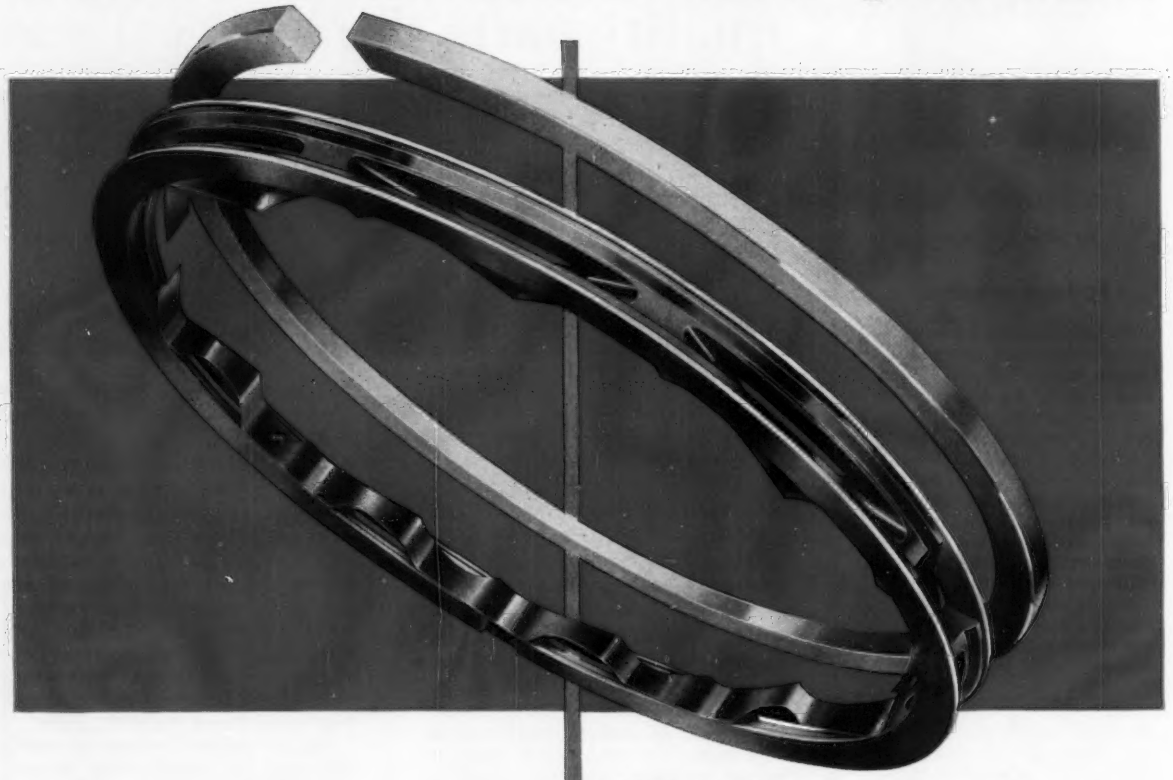
under continuous heavy loads!



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Agricultural Engineering

October, 1957
Volume 38
Number 10

James Basselman, *Editor*

Agricultural Outlook . . .

THE following comments and predictions on the past and future of the farm equipment industry were made by various manufacturers at the 64th annual convention of the Farm Equipment Institute in Chicago, September 16 to 18. These ideas reflect the economic situation of the country as a whole and point out how this affects the farmer who in turn causes the rise or fall of farm equipment sales.

R. S. Stevenson, president, Allis-Chalmers Mfg. Co., and chairman of the executive committee of the Farm Equipment Institute, told the convention that business for the farm equipment industry this year will average out better than last year. He said that a number of factors have contributed, but one of the most important was the ending of the drought in the West and Southwest. In his opinion customers are finding that buying cost-saving, modern power equipment is an investment and he reports that the farm equipment manufacturers have done an outstanding job in designing and building equipment which has greater use value to the farmer and in keeping equipment prices down. He stated that so far this year Allis-Chalmers' farm equipment sales have been running at a rate somewhat ahead of last year's. He believes that there is a good deal of stability in the farm equipment market and looks for this stability to continue during the balance of this year and the early part of 1958.

The executive vice-president of J. I. Case Co., M. B. Rojtman, reported that an evaluation of the farm equipment industry seems to indicate no major change forthcoming for 1958; however he said that more and more farmers have improved their profit picture. The answer for the American farmer seems to lie in greater efficiency which means higher production and lower cost through the use of even more modern machinery. An important solution for the farm equipment dealer has been an extension of his activities into the local construction market in his community.

The opinion of George C. Delp, president of New Holland Machine Co., was that the farm equipment industry's most important job is to provide farmers with the kind of machines they want to help them cut cost. He said today's modern equipment can help farmers harvest the higher quality feed crops they need to lower feed bills. The farmers know this and want the best machinery they can get.

H. C. Hanson, president of Hanson Equipment Co., predicted that the farm equipment business in general will be about the same in 1958 as in 1957. He said that crop production this year is the smallest since 1951 and will have some effect on sales for next year. Livestock production seems brighter and farm prices are up slightly, but farm labor rates are up which means smaller purchasing power for the farmer next year. He believes the sprayer business will be better because of new products, insect conditions and normal moisture.

Gail E. Spain, vice-president of Caterpillar Tractor Co., anticipates that 1958 will be even better than 1957. However, he pointed out that the tractor business is flavored by construction volume, and perhaps is not a true yardstick with respect to the farm equipment industry.

The chairman of the board of International Harvester Co., John L. McCaffrey, believes that the outlook for 1958 is for continued improvement in the farm equipment business. He said that several factors combine to give this optimistic viewpoint. The most important being the heavy rains of 1957 which broke the long drought in many west and southwest areas. He reported that there has been an upward trend in farm commodity prices and that government programs of aid to agriculture are not likely to be reduced in 1958. Finally, the long-term trend toward larger farms and greater mechanization seems certain to continue, and the farm equipment industry will undoubtedly present a number of new and improved machines which farmers will want in order to increase their efficiency and profits.

The outlook for a very modest increase in farm income, combined with other factors, causes Merritt D. Hill, general manager of the Tractor & Implement Div., Ford Motor Co., to believe that 1958 will be a better year than 1957 for the farm equipment industry. He stated that the four-year decline in farm income came to a halt in 1956, and the upturn has continued into 1957. Indications are that 1957 farm income will be between two and three percent above 1956, and studies indicate that farm income in 1958 will be slightly higher than in 1957, probably less than two percent.

A promising future for farm machinery manufacturers was predicted by Curry W. Stoup, vice-president of Avco Mfg. Corp. and general manager of Avco's New Idea Div. He reported that some of the factors responsible for a good future are the decrease in the number of workers on farms, the cost-price squeeze farmers have been experiencing and an increasing replacement market. The long range trend of a growing population with a gradual decrease in total farm workers indicates a long range future for those companies and dealers who meet the need for new, more efficient machines.

Bruce Lourie, vice-president of Deere & Co., reported that sales of his company in 1957 have shown an increase over 1956 and he expects this trend to continue in 1958 for the following reasons: Farm income is improving, crop conditions are generally favorable, increasing opportunities for the sale of equipment for "off-the-farm" uses, many new products will be available as well as improvements in current machines which will further reduce the long hours formerly required in farming operations, and the increasing population in the United States which will require increasing amounts of food and fiber.

Impeller Blade Shape Affects Forage Blower P

J. P. Raney and J. B. Liljedahl
Assoc. Member ASAE Member ASAE

POWER requirements of currently produced forage blowers are excessive for the useful work done and mechanical efficiencies are in the order of about 10 percent (2)*. One of the major reasons for the low efficiency of the forage blower appears to be the result of friction between the forage material and the housing of the machine. Recent work with both forage harvesters (1) and forage blowers (4) indicates that friction accounts for as much as one-third to one-half of the total power requirement of the machine.

Any material which is carried past the cutoff point (last possible point at which material can enter the blower pipe) is dragged almost one full revolution around the housing. Likewise, material reaching the housing ahead of the cutoff point is dragged some distance around the housing before being discharged. Various considerations affect the unloading characteristics of the blades of a forage blower. Some of these are tip clearance, point of in-feed to the impeller, diameter of the impeller, location of cutoff, and impeller blade shape to name a few. A significant reduction in power requirement would seem possible if a forage blower could be designed which would deliver the material directly up the pipe with little or no material ever reaching the housing (3).

*Numbers in parentheses refer to appended references.

Paper prepared expressly for AGRICULTURAL ENGINEERING. Authorized for publication as Journal Paper No. 1095 of the Purdue Agricultural Experiment Station, Project 634.

The authors — J. P. RANEY and J. B. LILJEDAHL — are, respectively, instructor in mechanical engineering and associate professor of agricultural engineering, Purdue University.

Objectives of Investigation

It was felt by the authors that the shape of the impeller blades determined, to a large extent, their unloading characteristics and, hence, the power required by excessive friction in the machine.

The purpose of this study was, then, to investigate experimentally the effects of various impeller blade shapes on power requirement with the hope of determining a blade shape which would reduce friction to a minimum. An additional objective was to determine the effect of increased tip clearance on one of the sets of blades.

Horsepower Tests

An Allis-Chalmers machine was selected because of the relative ease with which various interchangeable blade shapes could be designed for use in this machine. Three blade shapes (Fig. 1) were selected.

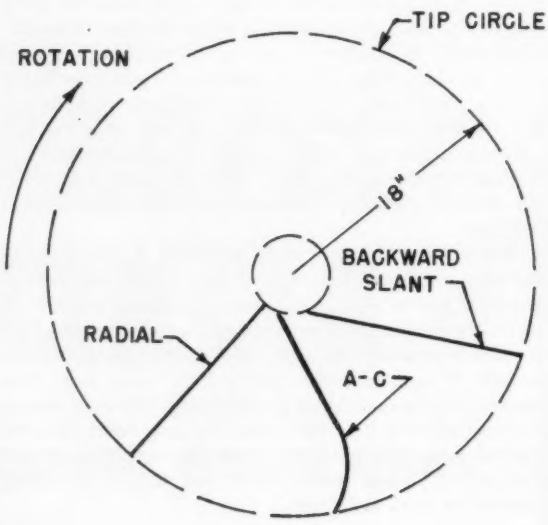


Fig. 1 Line sketch of blade shapes. Note: Two sets of A-C blades were used — one standard and one with 3/16-in. greater radial tip clearance

Performance

Engineers, not willing to accept low work efficiency in forage blowers as a necessary evil, have studied various impeller blades and blade positions with encouraging results

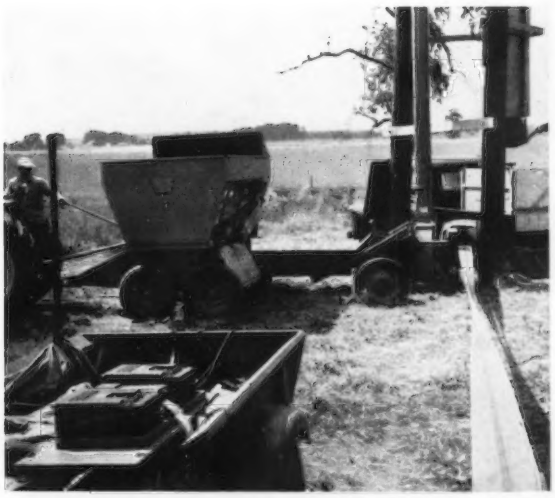
(a) forward curved (A-C regular)
(b) radial
(c) backward slant (16 deg)

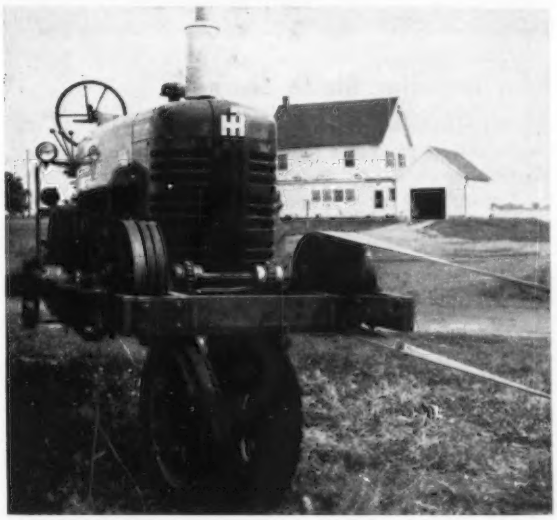
The radial and backward slant blades were selected in addition to the forward curved blades in order that three basic shapes could be studied. Tip clearance and radial projected blade area of these three sets of blades were maintained constant so that blade shape was the only variable. An additional set of Allis-Chalmers blades, A-C short, with 3/16-in greater tip clearance were also provided bringing to four the sets of blades tested.

Normal field conditions of harvesting and putting up the forage material were maintained for the experimental work. The tests were conducted in June of 1956 using a heavy second year stand of an alfalfa-timothy mixture at about ⅞ bloom. The material was harvested with a new forage harvester set to give a theoretical cut of ½ in. The material was harvested directly into a small, self-unloading wagon used to feed the blower.

The test site provided for a means of holding the blower pipe, a means for collecting the material for weighing, and electric power for the instrumentation (Fig. 2).

The material was elevated to a constant height (40.3 ft from the eye of the impeller to the top of the gooseneck),





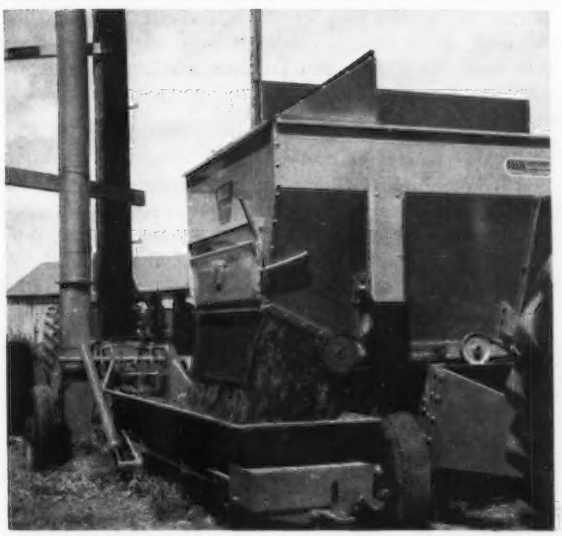


Fig. 2 *(Top)* Test site showing wagon, pick-up truck and instruments for measuring power • Fig. 3 *(Center)* Countershaft used for torque measurement • Fig. 4 *(Bottom)* Wagon feeding the blower

Fig. 5 Measuring a vertical trajectory

. . . Impeller Blade Shape

directed downward into a section of furnace pipe, and caught and weighed on a scales in the bed of a pick-up truck. The tests were timed with a stop watch. Torque was measured using SR-4 electrical resistance strain gages (1) (4) on a countershaft on the tractor used to drive the blower (Fig. 3). An interval marker driven by breaker points on the countershaft recorded speed on the oscillograph record. The self-unloading wagon (Fig. 4) delivered the chopped forage to the blower at a uniform rate of feed.

The tests were conducted at two blower speeds of 860 and 700 rpm and two rates of feed of about 400 and 700 lb per min. The recommended maximum blower speed was 850 rpm and 700 lb per min was nearly the maximum feed rate that could be conveniently handled. The test runs for each set of blades were replicated twice and completed in one day's testing. Samples for moisture content determination were taken several times during the test runs. The forage material was loaded back into the wagon after each test run, but little or no material passed through the blower more than once. Each day's test runs were randomized to minimize the effect of any possible change in the material during each day's test period.

Vertical Trajectories

In comparing differences in power requirements, at a given blower speed, for any two sets of blades, it was recognized that this difference might easily be due to one set of blades imparting less energy to the forage material and not necessarily to better operating efficiency of the blades.

A method was needed then to determine, at each blower speed, what portion of the horsepower difference between sets of blades was the result of reduced friction horsepower and how much was the result of less useful work being done on the material. The method selected was that of removing the gooseneck from the blower pipe and allowing the material to be elevated vertically beyond the top of the pipe (Fig. 5). The elevation of the top of this vertical trajectory of the material was measured with a surveyor's transit. The rate of feed was held constant at 700 lb per min for all blower speeds. From the data thus obtained it was possible to determine height of the vertical trajectory as a function of blower speed and this relationship in turn was used to help account for any apparent differences in the power requirements of the sets of blades.

Results

The results of the horsepower tests are shown in Figs. 6 and 7. These results have been adjusted to the speed indicated in each figure to compensate for some speed variation which occurred between sets of blades in the actual testing. Since two feed rates were used at each speed, the results are presented as straight lines.

The performance of the sets of blades at a blower speed of 860 rpm (Fig. 6) varies from 23 to 44 hp at a rate of 600 lb per min. At a speed of 700 rpm (Fig. 7) the variation is from about 20 to 33 hp. In each case the backward slant blades required the least power and the radial blades required the most.

All blades required less power at 700 rpm than at 860 rpm which indicates that, regardless of blade type, the lower operating speed was the more economical. No attempt was made to determine minimum operating speeds because this would have resulted in plug formation and all the unpleasantness incurred by this condition. Only one plug was formed during the entire test period and that one was formed intentionally.

Increased tip clearance of the forward curved blades resulted in a lower power requirement of these blades, especially at the lower speed of operation.

The results of the vertical trajectory tests (Fig. 8) show that the backward slant blades elevated the material higher at all blower speeds than the other sets of blades. The forward curved regular and short blades elevated the material to about the same heights. The radial blades could not attain a speed much higher than 800 rpm, but, for the speeds possible, they elevated the material higher than the forward curved blades but not as high as the backward slant blades.

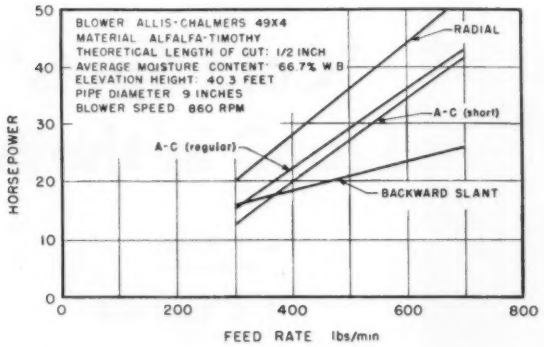


Fig. 6 Horsepower curves for four different blades adjusted to 860 rpm

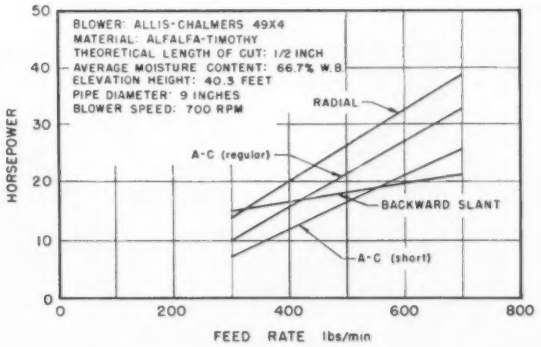


Fig. 7 Horsepower curves for four different blades adjusted to 700 rpm

Discussion and Conclusions

At 860 rpm and a feed rate of 600 lb per min the forward curved blades required 37 hp while the backward slant blades required about 23 hp. The question which now arises is whether or not this difference exists because the backward slant blades perform more efficiently or merely because they do less useful work on the forage material.

The answer to this question is found in examining the results of the vertical trajectory tests shown in Fig. 8. Since the backward slant blades elevated the material substantially higher at all blower speeds than the forward curved blades, it may be concluded that the backward slant blades required less horsepower because of better efficiency and that they imparted as much, if not more, energy to the forage material than did the forward curved blades.

Likewise, because the heights of the vertical trajectory for both sets of forward curved blades were nearly the same, it can be concluded that increased tip clearance of these blades results in a lower power requirement especially at lower speeds of blower operation.

Because power was limited by the V-belt drive to the countershaft, the radial blades did not attain speeds of much over 800 rpm, but at the speed attained they elevated the material higher than the forward curved blades. This indicates that their relative performance might possibly be better than that indicated by Figs. 6 and 7. They might require about the same horsepower as the forward curved blades if both sets of blades were performing an equal amount of useful work.

It is recognized that variables other than blade shape may affect the performance of a forage blower. One machine using one forage material was used for the experimental work and it would be difficult to predict how the blade shapes tested would perform in blowers of other dimensions using other forage materials.

Perhaps a better method of comparing blade shapes would be to determine first the required configuration of a machine for optimum performance with each given set of blades and then to conduct experimental tests for determining the relative performance of each.

Further tests are needed in order to determine whether or not the backward sloped impeller blades perform as well under other conditions of operation as they did for these tests.

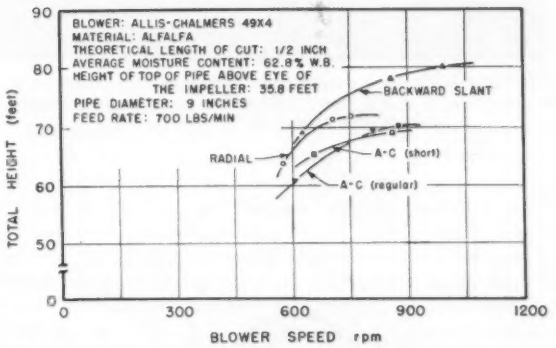


Fig. 8 Height of vertical trajectory vs. blower speed for four different blades

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. . . Membership Month

(Continued from page 700)

during October will be processed in time to permit new applicants to become members before the next calendar year. These new members will be assured a full year of section meetings and society services; and the individual sections will profit by the new ideas, new contacts and friendships, and increased circle of intellectual and social associations provided by the new members.

October is the month for fall cultivation of contacts to stimulate maximum professional growth and development throughout the autumn and winter seasons. This will allow ample time for necessary follow-up contacts before the active season is past. The acquisition of new members in an organization is the responsibility of each member; and if the members *want* their organization to grow, it *will* grow. What will the record show for ASAE's first Membership Month . . . October?

Fig. 1 Portable radiation measuring instruments (from left) globe thermometer, Gier directional radiometer, portable potentiometer, and total energy hemispherical radiometer

"Cold Spots" in the Sky

C. F. Kelly
Member ASAE

T. E. Bond and
Member ASAE

N. R. Ittner

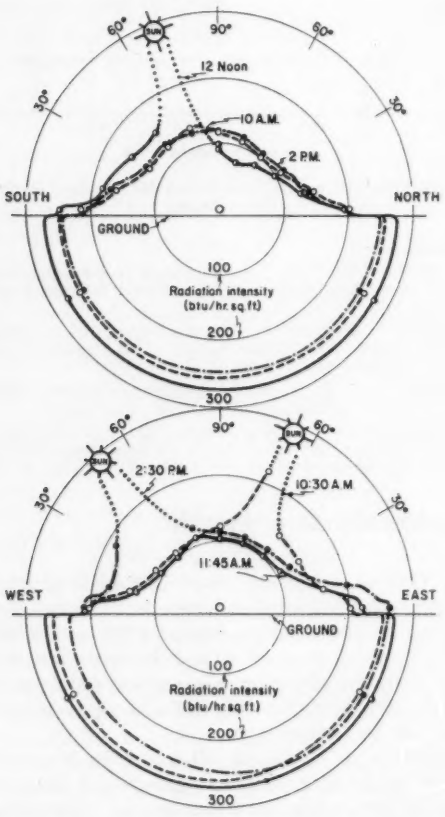


Fig. 2 *(Above)* Traverses of Gier directional radiometer in north-south *(top)* and east-west *(bottom)* directions, on a clear day

SHADES designed to cut off solar radiation and thus reduce the radiation heat load on livestock have been studied cooperatively by the U.S. Department of Agriculture and the University of California (at Davis and at the University's Imperial Valley Field Station at El Centro) and have been previously reported in AGRICULTURAL ENGINEERING (3, 11, 13)*. Shades were found to reduce the radiation heat load from the upper hemisphere by 50 to 65 percent and that from the lower hemisphere by about 25 percent. Main benefit of a shade is to replace intensely hot solar radiation with a much cooler surface. However, the shade also shields animals from the rest of the sky dome or upper hemisphere and has the disadvantage of replacing the cool sky with a hotter surface. This paper discusses the upper hemisphere as a cold sink, presents some radiometer observations upon it, and gives the results of experiments at El Centro with two types of shades especially designed to attempt to make use of this cold sink.

Nature of Upper Hemisphere or Sky Dome

As viewed from earth on a hot, cloudless day, the sky seems to consist only of the sun. Radiating as a black body

*Numbers in parentheses refer to appended references.

Paper prepared expressly for AGRICULTURAL ENGINEERING.

The authors—C. F. KELLY, T. E. BOND and N. R. ITTNER—are, respectively, agricultural engineer, University of California; agricultural engineer, U. S. Department of Agriculture, and animal husbandry specialist, University of California.

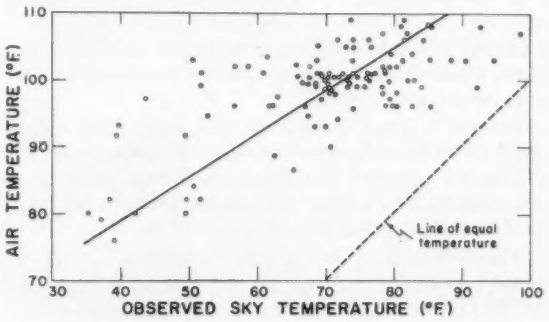


Fig. 3 *(Right)* Relation of air temperature at ground to effective north sky 60 deg above horizon

May Help Cool Livestock

It may be possible to design shelters in such a way that the roofs and walls will serve to transfer heat from the ground to cold spots in the sky. Ideally, such shelters would expose the animals to a large expanse of cool sky and at the same time protect them from direct rays of the sun

at a temperature of 11,000 F, it gives forth heat that apparently strikes us from all directions because of reflection from surroundings or secondary radiation from objects that have been heated by absorbing solar radiation. However, the sun, although at a very high temperature, is comparatively small when compared with the upper hemisphere or dome of the sky; its shape factor with respect to the earth is only 1/46,000 of half space and it subtends a solid angle of only ½ deg (5). The remainder of the upper hemisphere would radiate at a very low intensity if it were not for the back radiation from the atmosphere of the earth and reflectance from clouds. Water vapor and gases radiate to earth and to space, and in effect screen the earth from radiating directly to space, especially in the long-wavelength range. Dust and clouds contribute to the upper hemisphere radiation by reflecting a portion of the short-wave solar radiation from angles other than the direction of the sun (diffuse radiation). Thus, radiation from the upper hemisphere (less the ½ deg solid angle subtended by the sun) is dependent upon the temperature and concentration of water, gases, and dust in the earth's atmospheric layer, rather than upon the temperature of space, or —441 F (2).

Instruments

Many types of radiometers are available for measuring radiosity of the surround. These vary from globe thermometers, which measure spherical radiation (1, 3), and total-energy plate radiometers (8, 12) and the Eppley pyrheliometer (14, 16), which measure half-space radiation, to instruments such as the Gier directional radiometer (7, 12), which measures energy from a solid angle of only 16 deg.

The Gier radiometer, because of its directional properties, portability, and ruggedness as a field instrument, was used to collect the data from the sky, and other instruments were used to supplement and describe general sky and ground radiosities. Portable instruments used in the study are shown in Fig. 1.

Observations and Discussion

From 1947 to 1956 many observations were made with directional radiometers. Traverses from horizon to horizon across the sky in north-south and east-west directions indicated that azimuth orientation had small effect upon sky radiosity throughout the hot part of the day when the instrument opening received no direct-beam energy from the sun and the sky was free of clouds. But angle of elevation is important—an angle of 60 deg above the horizon was usually the "coldest". This is shown in Fig. 2 where radiosities are given for both upper and lower hemispheres, as observed at El Centro, Calif., on April 27, 1949—in the upper section for a traverse in the north-south orbit, in the lower section for the east-west orbit. The measurements were made at approximately noon and two hours before and after noon in each case. A Gier directional radiometer (Fig. 1), angle of exposure 16 deg, was used for the traverses, observations being made at 20-deg intervals through the upper hemisphere and at greater intervals through the lower hemisphere. The sky was hazy but cloudless and the ground bare of vegetation. The energy values are in terms of intensity of radiation (Btu per sq ft-hr) upon a surface normal to the axis of the instrument.

Two important ideas relative to livestock cooling and shade construction are illustrated in Fig. 2:

(a) The intensity of daytime radiation from the upper hemisphere (excluding the sun) is very low when compared with the intensity of the lower hemisphere; and

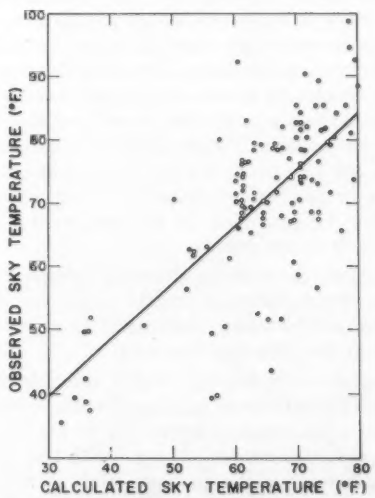


Fig. 4 Relation of observed to calculated sky temperatures, using Brunt's (6) empirical formula

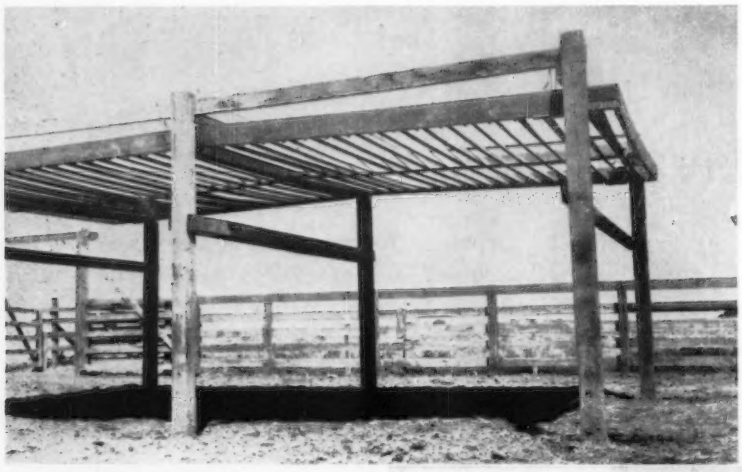
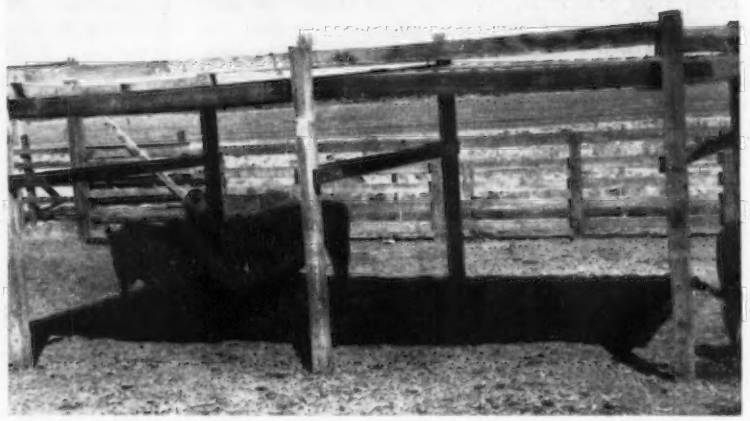


Fig. 5 Views of louver shade. Note solid shadow. North is on left of both views. Arrangement of louvered boards is shown at left; cattle grouped under north end illustrated below



. . . Cold Spots

(b) The north sky at an angle of about 60 deg above the horizon is usually the lowest radiating direction of the upper hemisphere during the hot period of the day.

The latter point was found to be true in many other traverses made on cloudless days at both Davis and El Centro. As summarized by Pleijel (15) in reporting the work of others, the temperature of a clear sky "results in a minimum at a compass point opposite to that of the sun and approximately at right angles to the direction of the sun." This means that the lowest temperature "cold sink" available for absorbing radiant energy from objects on the earth's surface (and from the earth itself) is constantly changing position. For a hemispherical building, such as an igloo, it will make little difference where in the sky this cold area is. But for a rectangular building, such as a livestock shelter, where the problem is to cool the animals directly by long-wave radiation exchange between animal and sky and at the same time keep solar and shade radiation to a minimum, we must have one area in the sky on which to base design. It would not be practical to design a moving opening that could follow the cold area. So we must select a spot area from which to obtain data.

As the north sky at 60 deg above the horizon usually had the lowest effective temperature, the single observation in this direction will be used to characterize the radiating power of the sky in the following discussion.

The period in the Imperial Valley which is considered to be depressing to livestock gains and production because of temperature is June through September. In Fig. 3 a series of 116 north-sky temperatures, observed with the Gier directional radiometer, has been plotted against air temperatures obtained at the same time 42 in above the ground. All observations were made between 10 a.m. and 5 p.m. on cloudless days (less than 10 percent cloud cover) during the months of July to September. A linear regression curve has been fitted to these points. Its equation is: $t_s = -81.9 + 1.5\ t_a$, where t_s is the temperature of the sky (F) and t_a is the temperature of the air (F). The correlation coefficient is 0.74. A difference of about 28 deg between air and sky is available as a cooling sink at an air temperature of 100 F, and of about 22 deg at 110 F.

The temperatures of the sky are calculated from sky radiosities by the Stefan-Boltzmann formula, using an emissivity for the sky of 1.0.

In predicting sky temperatures from ground observations with instruments other than radiometers it would appear that more than air temperature should be used to describe the radiating properties of the atmosphere. Water vapor, gas content, dust particles, air mass—all contribute to the absorption, back radiation, reflection, or transmission of radiant energy in the atmosphere. Brunt (6) has derived a possible method of calculating incoming radiation from observations of air temperature and vapor pressure at the ground by use of the formula $R = \sigma T^4 (a + b\sqrt{e})$, where R is the incoming radiation (Btu per sq ft-hr), σ is the Stefan-Boltzmann radiation constant, T is the temperature of the earth (°R), e is the mean monthly local vapor pressure

of the air at the earth's surface in millibars, and a and b are constants. Using Brunt's value of 0.55 for a and 0.056 for b, and values for e from surface readings at the time of the radiometer observations, these calculations were made and plotted against the observations for the same set of 116 readings (Fig. 4). The equation of the regression line is: $t_o = 13.7 + .88\ t_c$, when t_o is the observed sky temperature and t_c is the calculated sky temperature. Other investigators, listed by Goss and Brooks (9), have determined different values for the constants in Brunt's equation, but none were found to give calculated results as close to the observed as these.

While a graph such as Fig. 4 can be used to estimate sky temperature from air dry- and wet-bulb temperatures at the ground, the use of a directional radiometer in each region of the country to develop curves from actual observations would be much more desirable.

It should be pointed out that the foregoing discussion assumes a cloud-free sky, as will be found in most hot desert areas such as the site of these studies. A cloudy or overcast sky will alter conditions rapidly. At Davis the north-sky temperature lowered in a few minutes from 90.5 F with an overcast sky to 59 F when the sky cleared, with an accompanying lowering of only 1 deg in wet-bulb and an *increase* of 2 deg in dry-bulb temperatures. The highest north-sky temperature we have observed, 111 F, was at El Centro during an overcast period. In a few hours, with the passing of the overcast, the sky temperature dropped to 56.5 F. Fortunately, there is less need for shades during cloudy weather because of both lower air and sky temperatures, and therefore less need for a cold sink.

Application

The value of a shade design that will expose the animal to a large proportion of cool sky while at the same time shutting out direct solar radiation is evident from the preceding discussion. In the northern hemisphere a high rectangular shade, oriented in the east-west direction, partially meets this condition, especially if the animals locate themselves at the north edge of the shadow, as far from the shade surface as possible (13). The benefit from direct radiation cooling to the sky is least, however, when the sun is at its maximum altitude, because then the area of shadow to the north of the shade is the smallest. Two ways of increasing the north-sky exposure were studied at El Centro and at Davis: louvered shades and vertical shades.

Louvered Shades: A louvered shade, designed to give animals standing beneath it maximum exposure to the north sky, and at the same time protect them from direct solar radiation, was tested at El Centro in 1949. The angle and the spacing of 1 x 10-in boards were calculated for the latitude of El Centro (32 deg 30 min north Lat.) and noon of the longest day of the year (June 21) when the maximum elevation of the sun is 81 deg. At this time the shadow on the ground was solid, with no streaks of sunlight. However, with the designed angle of the boards 49½ deg above the horizontal, the overlapping of the 1 x 10-in boards was not enough to prevent light streaks before 10 a.m. and after 2 p.m., when the sun, although not as high in the sky, was farther north. The design time should have been two hours either side of 12:00 noon to provide a solid shadow during most of the hot part of the day.

The overall size of the shade (Fig. 5) was 13½ ft x 22 ft; height above ground was 6 ft, later raised to 9 ft. It was erected in a 50 x 60-ft pen of the experimental beef cattle corrals on the station. A galvanized iron shade and a double-roof metal shade in two adjacent and similar pens were used as checks to learn which type of shade the animals preferred. The galvanized iron shade was known to be relatively poor and the double-roof shade a good one from tests of the previous year (10). Eight steers (4 Hereford and 4 Braford) were allowed free access to all shades during the hot summer months, so they could choose the location with the most comfortable thermal environment. They were fed in the pen with the louvered shade, so that as far as convenience was concerned this shade should have been the first choice. The nearer of the other two was the galvanized iron shade. In spite of the convenience of these two, the galvanized iron structure was never used, and the louvered shade seldom. The animals preferred the double-roof shade.

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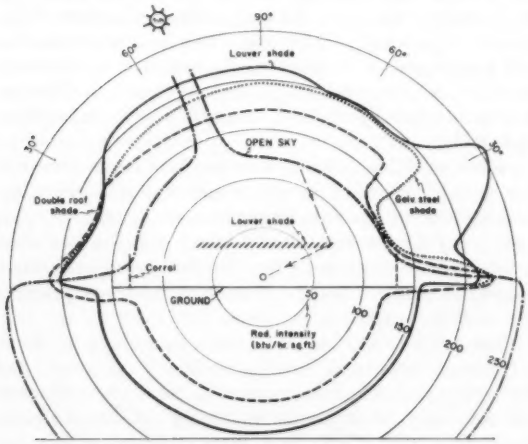

Fig. 6 *(Above)* Intensity of radiation as measured from north to south under galvanized steel, double-roof, and louver shades, compared with open sky

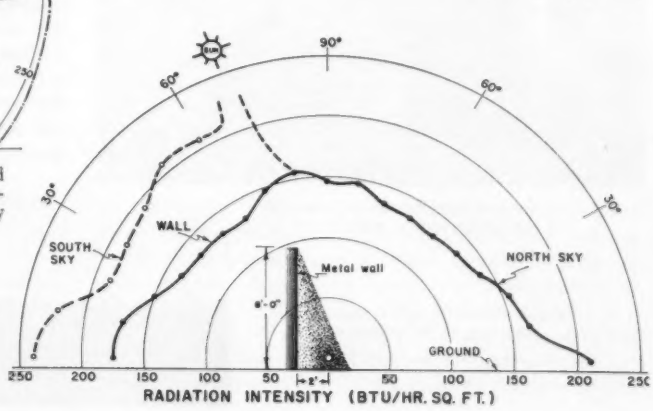

Fig. 7 *(Right)* Intensity of radiation (north-south traverse) near a bright vertical wall, as compared with no wall

Preparing Land for Mechanization in the Southeast

T. E. Corley, Member ASAE **J. O. Helms,** Assoc. Member ASAE
F. A. Kummer, and C. M. Stokes
Fellow ASAE Member ASAE

This article illustrates the important role an agricultural engineering experimental farm played in advancement of mechanization on the rocky and rolling land of the Southeast

THIS story is about a farm development based on new concepts of land preparation aimed at establishing methods and practices by which complete farm mechanization might be realized on the rolling land common to southeastern United States. This development has been in progress for eight years on the agricultural engineering farm unit, Alabama Agricultural Experiment Station, Alabama Polytechnic Institute at Auburn.

A look at the farm mechanization picture as it existed in the Southeast in 1949 shows why the development of new land preparation methods was so badly needed.

The sales of farm tractors and machinery skyrocketed during the period 1947-1949(1)*. Farmers were fast replacing mules with tractors but they were slow in realizing that proper land preparation for mechanized farming is quite different from that needed for mule farming. Many farmers and farm leaders were quick to criticize farm machines for failing to operate satisfactorily on poorly prepared land. Some of the failures were due to machine design, but in many cases, poor performances of planting, cultivating, and harvesting machines were caused either directly or indirectly by poor land preparation.

To the agricultural engineers who were selling, testing, and developing farm machinery in this area, it soon became apparent that the change to complete mechanization must begin with a change in land preparation. They also realized that land preparation for mechanized farming involves more than just tillage of the soil—it involves soil and water conservation, field and row layout, land selection, land smoothing, and many other practices. Agricultural engineers had begun to envision land preparation as the first step of a well planned program designed to use machinery and take advantage of the many technological advances of farming.

In 1949 the agricultural engineering department, Alabama Polytechnic Institute, obtained 100 acres of land to be used as a field laboratory for farm machinery and other agricultural engineering applications. This land was located in and was typical of millions of acres of land in the Piedmont area of Alabama, Georgia, and the Carolinas. The area is characterized by rolling, variable, rocky, and eroded topography.

Much work had to be done on this land before farm machines could be used or it could be used as a field laboratory. Development of the farm was planned to serve two purposes: *(a)* to provide suitable land for the operation of all kinds of farm machinery for laboratory instruction, and *(b)* to establish land preparation methods and practices that could be adapted to the area.

The first step was to remove rocks from the field. Most of the rocks were on or near the surface of the ground but they were too numerous to remove by hand. A mechanical rock rake was developed by modifying a Graham-Hoeme chisel plow. All of the tines were mounted on the rear

*Numbers in parentheses refer to the appended references.

Paper prepared expressly for AGRICULTURAL ENGINEERING.

The Authors—T. E. CORLEY, J. O. HELMS, F. A. KUMMER, and C. M. STOKES—are, respectively, agricultural engineer, Alabama Polytechnic Institute and (AERD, ARS) USDA; farm superintendent, agricultural engineering department; head, agricultural engineering department; and associate agricultural engineer, Alabama Polytechnic Institute, Auburn.

Acknowledgment: The authors are grateful for the assistance of A. W. Cooper, assistant director, Tillage Machinery Laboratory (formerly project supervisor, SCS research), and C. M. Sanders, SCS drainage engineer, for their valuable assistance in planning the terrace system for mechanization.

Fig. 1 *(Above)* A modified chisel plow used to rake rocks into a windrow

Fig. 2 *(Right)* A cotton picker crossing a "W" outlet

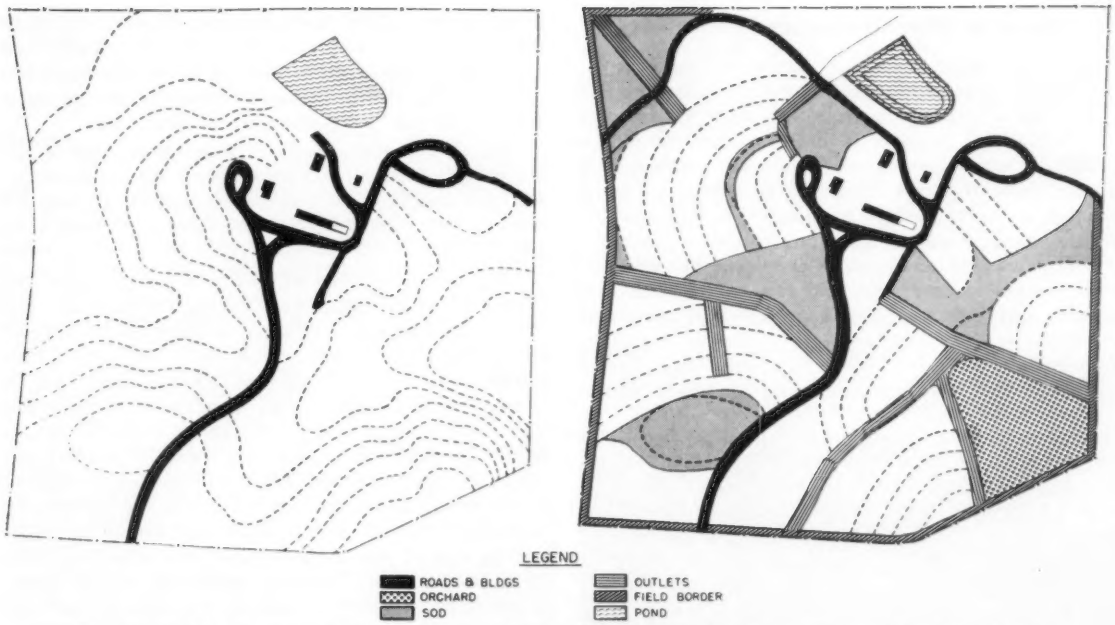

Fig. 3 *(Left)* Map of conventional terrace system • Fig. 4 *(Right)* Map of terrace system designed for mechanization

frame of the plow and extra tines were added to decrease the spacing between them. A hydraulic dumping mechanism was also added. This machine did an excellent job of raking the rocks into a windrow (Fig. 1). The rocks were then loaded onto a dump truck by means of a tractor loader to which extra tines had been added. Of course, some rocks were missed by the rake and others were brought to the surface during subsequent tillage operations—these were removed by hand.

The next step was to prepare the field for laying out a terracing system. A bulldozer was used to fill gulleys, remove stumps, eliminate hedge rows, and to push down any old terraces.

A terracing system was laid out and constructed according to the conventional method (2) where the location and channel grade of the terraces are based on soil type and slope of the land. Years of field experience had proved that this system was satisfactory for mule farming and from a conservation standpoint. However, this system as shown in Fig. 3 was not conducive to efficient operation of tractor equipment, especially multiple row equipment. There were sharp turns in the terraces that made it difficult to maneuver tractors and machines even at slow speeds. The terraces were unevenly spaced throughout the field, resulting in numerous point rows that were undesirable for mechanized operations. After three years of operation, it was decided that a terracing system that lends itself to mechanization in addition to conservation must be developed.

Local Soil Conservation Service research and field engineers were called in for advice. After mapping and studying the land, it was decided to do away with the present terrace system and to develop a new system designed to include water disposal outlets in the major draws to make it possible to straighten and more evenly space the terraces.

In the fall of 1952, old terraces were eliminated and new outlets were constructed. The new terraces were not to be

Fig. 5 Aerial view of terrace system shown in Fig. 4. Terraces have been etched in

constructed until a year later to allow vegetation in the outlets to become established. Both *V* and *W*-type outlets were built. The outlets were flat and shallow to permit crossing with equipment (Fig. 2). They were seeded with a mixture of fescue, Ladino clover, and oats. The oats were used as nurse crop to prevent erosion until the fescue and clover became established. In the spring, crops were planted between the outlets. The rows were laid out on the contour so that row drainage would aid in water control until terraces could be built.

In the fall of 1953, the new terrace system was laid out and constructed (Fig. 4). A key terrace was first laid out and whenever practicable the other terraces were laid out parallel to the key terrace. The terrace intervals and channel grades were not always in agreement with those specified by the conventional method. On fields with a slope of 3 to 5 percent, the distance between parallel terraces was 80 ft and on fields with slopes of 5 to 7 percent, the interval was 67 ft. The distance between terraces was always a multiple of four

. . . Land of Mechanization

40-in rows. The addition of the outlets decreased the distance that the terraces had to carry water and made it possible to use channel grades differently from those recommended for conventional terraces. In order to keep the terraces parallel, it was sometimes necessary to use relatively steep channel grades for short distances. Because of good row drainage no undue washing has occurred in these channels and they have proved satisfactory on this land.

Where parallel terraces were not possible, the rows were made parallel to one terrace and areas where point rows occurred were vegetated (Figs. 4 and 5). Some steep areas not suited for row crop were put in sod or hay crops. Borders, 20-ft wide, were provided along the fence lines for easy access into rows and for turning equipment without damaging crops. The outlets, borders, and other areas taken out of row crop production totaled about 20 percent of all open land. Most of the land taken out of row crops was used advantageously in the production of seed and hay crops. The borders and outlets also served as field roads.

Fig. 6 *(Top)* A four-row cultivator plowing cotton on a broad terrace • Fig. 7 *(Center)* A crawler tractor with chisels mounted in front and harrow hitched in rear • Fig. 8 *(Bottom)* A land leveler operating on contoured land

All terraces were constructed with a broad base of sufficient width to permit four rows between channel and ridge. Four-row equipment has been used satisfactorily to plant and cultivate cotton and corn on these terraces for three years (Fig. 6).

Most of the land had only a few inches of top soil and in some places the subsoil was exposed. On these areas and in terrace channels and other areas where the topsoil had been removed during the construction of the terraces, only shallow penetration of moldboard and disk plows could be obtained. Chisel plows proved beneficial in breaking this land ahead of the turning plows. The land was turned to a depth of at least 6 in to insure penetration of planting and cultivating equipment and anhydrous ammonia applicators. Fig. 7 shows a D-4 Caterpillar tractor that was modified by mounting the chisel plows on the tool bar in front and hitching a heavy disk harrow behind for chiseling and disking in one operation. Two-way moldboard and disk plows have been used for turning the land. The two-way plows are excellent for terrace maintenance, for eliminating dead furrows between terraces, and for preventing elevated field borders. The absence of the elevated field borders made it possible for the rows to drain into the outlets.

In 1951, a land leveler was obtained for use on this terraced, rolling land. Heretofore, the use of land levelers had been confined mostly to land leveling operations in the flat lands of the Mississippi Delta and the West. The use of the leveler on this land was intended primarily for smoothing land. This smoothing greatly improved planting, chemical weed control, and other operations. The leveler has proved to be an excellent tool for smoothing between terraces, for terrace maintenance, and for smoothing rough land (Fig. 8).

Since winter cover crops are important for controlling soil erosion in the Piedmont area, the cover crop should be planted early in the fall so it can become established for protection during the winter rains and for early winter grazing. With horse-drawn equipment, it was possible to plant between the rows of cotton before or immediately after harvesting. To continue this important practice in a mecha-

Fig. 9 A tractor mounted seeder planting a cover crop in cotton

nized operation, a tractor mounted seeder was developed for interplanting in cotton and grain sorghum (Fig. 9). This same seeder has been used for seeding grazing crops in pasture sod.

Results

A look at the 3-year period (1954-1956) farming operations on this land will complete this story.

During these years, all of the row crops (cotton, corn, soybeans, and grain sorghum) have been planted and cultivated with four-row equipment. (Four-row equipment is not normally recommended for this size farm, but it was used for laboratory instruction and for evaluation of the land preparation and conservation practices.) When this study was initiated in 1949, a one-row tractor generally was used and recognized as the only tractor for this type land.

By planting cotton to a stand and by using chemicals for weed control, hand hoe labor was practically eliminated. Previously, land preparation was not suited for precision planting as required for planting to a stand. Neither was it smooth enough for applying pre- and post-emergence chemicals.

All the cotton has been harvested with a mechanical picker. Heretofore, this costly and heavy machine was not considered suitable for use in the Piedmont area because of the rocks, steep terraces, point rows, and sharp turns in the rows. Combines were used to harvest soybeans, grain sorghum, fescue, oats, wheat, and clover. The corn was harvested with a snapper and picker-sheller.

Yields have been good, running as high as two bales per acre for cotton and 100 bu per acre for corn under irrigation. Such yields are most uncommon for this area.

Soil erosion has been practically eliminated and there has been a gradual buildup of soil fertility and an improvement in soil structure. This, within itself, is quite an accomplishment in the Piedmont area.

Is it practical?

The soils of this area respond readily to good management and cultural practices. Money spent developing this type of land will pay dividends through *(a)* increased value of land, *(b)* increased efficiency of labor and machines, *(c)* improvement in soil fertility and structure, and *(d)* increased yields. Undeveloped land in the Piedmont area is relatively cheap, but good land that lends itself to mechanization is costly. The money spent in developing low cost land will usually equal the difference in cost between undeveloped and improved land.

Elimination of sharp turns in the rows make it possible to operate the tractor at higher speeds and with greater accuracy. The higher speeds often increase the effectiveness of such implements as the rotary hoe and sweep cultivator. The elimination of point rows, the layout of continuous rows made possible by crossing the outlets, and the use of multiple-row equipment expedited and increased the efficiency of all machinery operations.

Summary

New concepts of land preparation for complete mechanization and soil and water conservation were developed on a Piedmont farm.

A system of terraces and vegetated outlets that lends itself to mechanization as well as conservation was designed and used.

Three years of completely mechanized farming proved the land conservation and preparation methods used to be sound and practical. Although this development was on Piedmont land, the same methods and practices should apply to other areas with similar problems.

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2 Wilson, J. B. and Neal, J. H. Terracing and related soil conservation practices for Alabama, Alabama Polytechnic Institute Circular 165, November, 1938.

Old Timer Gasoline Engine

THE senior agricultural engineers at the University of California dramatized the progress of internal combustion engine power at the annual Picnic Day in Davis last April by putting into action the first gasoline engine built by Soranus Standish in the mid-eighties to power his shop at Gridley, Calif. This engine is the vertical type, 3 hp, 6-in bore and stroke, weighing about 600 lb with a speed of 300 rpm. It has a flyball governor driven by belt off crankshaft, automatic injection, hit-and-miss control and is water cooled.

The story and photo were sent in by F. Hal Higgins, affiliate of ASAE since 1927. He reports that the engine has been gathering dust in a shed behind the Davis agricultural engineering building for the past 19 years, since he obtained it while tracking down some history of the Coffin and Standish steam plow. Mr. Higgins reports that on the eve of the picnic some student agricultural engineers dug it out, started it up and put it in the parade with four students riding the float to keep it popping. Although the engine kept running one spectator is reported as saying, "It sure did a lot of missing."

Soranus Standish claimed, according to a grandson, that the engine was the first gasoline engine built in the United States. Mr. Higgins says that Union Diesel Engine Co. of Alameda, Calif., and William Paterson of Stockton, Calif., also claim the honor, since they manufactured gasoline engines in 1883.

INSTRUMENT NEWS

Device Isolates Radiant Heat for Animal Heat Transfer Studies

R. E. Stewart
Member ASAE

Pilot model calorimeter designed to isolate radiant heat loss for heat transfer studies shows promise as aid to animal housing engineers

A BASIC problem related to study of animal shelter requirements is the determination of heat dissipation from animals to their environment. The partition of the heat dissipation into its components of convection, conduction, radiation, and evaporation is necessary for engineering design of shelters for maximum productivity. Heretofore, the heat losses have been partitioned into sensible (convection, conduction, radiation) and insensible (primarily evaporation) components. The instrument described in this article was constructed to allow determination of the *radiant* fraction of the heat loss, not only from animals but from any heat source.

The principle of "gradient" calorimetry has been used by Benzinger (1)* and by Lawton *et al* (3), among others, to allow rapid and continuous measurement of heat flow from animals and men. These thermoelectric calorimeters are based on the thermopile, or heat-flow meter principle. The meters are so constructed that a temperature difference (gradient), however small, causes a measurable voltage. Huebscher *et al* (4) described how the meters in Benzinger's (1) apparatus were constructed.

The present instrument was made with two thermopiles. The gradient was made in spiral fashion from copper-constantan ribbon (0.002 in thick, 0.25 in wide) wound on a plastic strip 0.02 in thick, as shown in Fig. 1. Alternate notching of the ribbon formed sets of thermojunctions in series. The spiral arrangement was suggested by samples seen in Benzinger's (5) laboratory. The basic 6-in x 1-in gradient thermopiles were assembled and bonded to aluminum plates as shown in Fig. 1, using "Scotchweld", heat, and pressure. The thermopile was insulated on both sides by plastic 0.02 in thick. By this means the interior of an aluminum box 4 ft long, 3 ft high, and 2 ft wide was completely lined with a gradient thermopile. See Fig. 2.

Heat transferred as radiation, convection, and conduction can be measured by the gradient thermopile. All sensible heat emitted within the calorimeter is therefore registered by the voltage output of the gradient thermopile. The separation of the radiation component was done as follows:

Fig. 1 shows that the radiation thermopile lies in a single plane. The basic strips are formed of flat copper-constantan ribbon, notched on alternate sides and bonded to the plastic surface of the gradient thermopile cover. Since all links of the thermopile lie in a single plane, no temperature gradient can be created by either convection or conduction heat. The single-plane idea apparently was tried first by Benzinger (2). The bare metallic chain of flat ribbon does not respond to radiation until alternate junctions are covered with aluminum-foil tape and their mates covered with radiation-absorptive tape. After covering, the radiation thermopile responds to heat transferred as radiation (by selective, comparative cooling of the aluminum-covered junctions) but not to any

*Numbers in parentheses refer to appended references.

The author—R. E. STEWART—is professor of agricultural engineering, University of Missouri.

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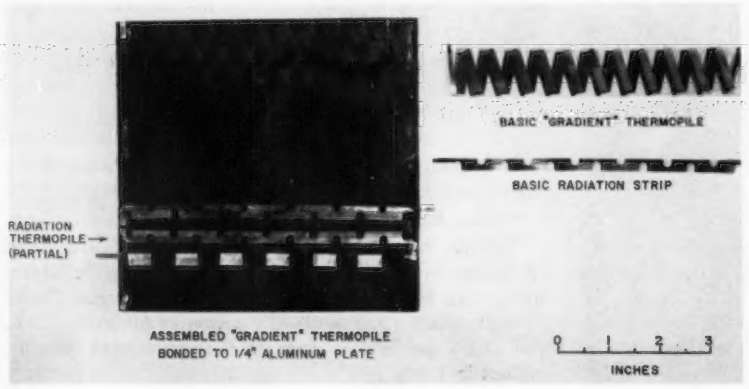


Fig. 1 Method of constructing the two types of thermopile used in the calorimeter is shown

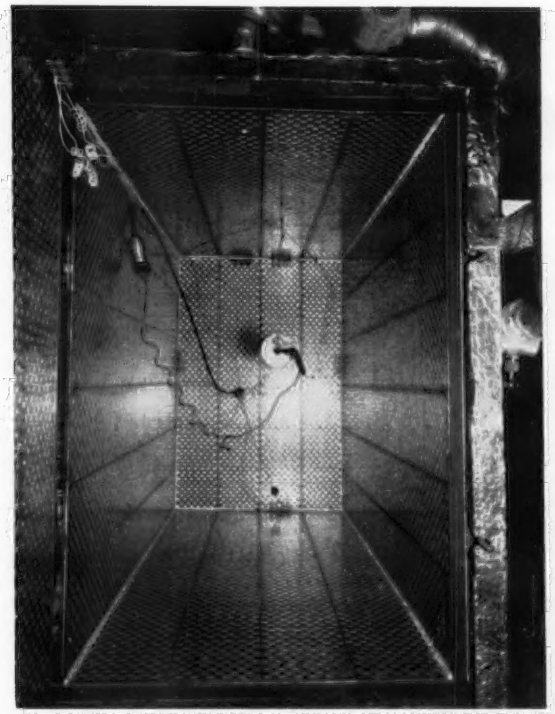
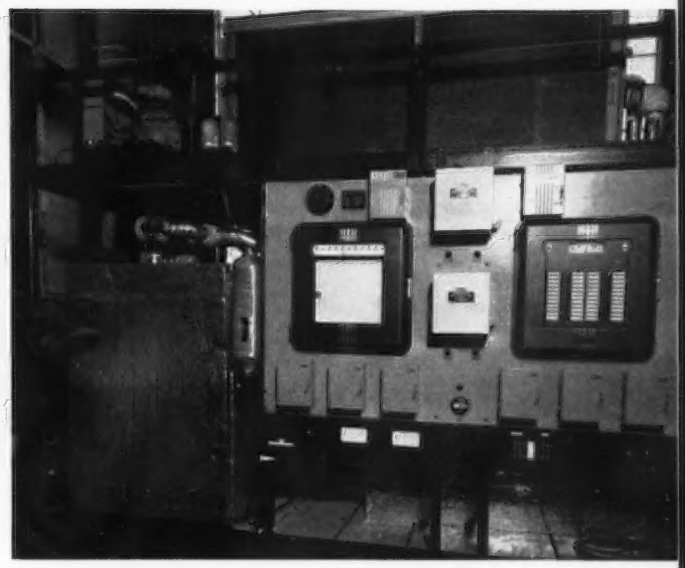


Fig. 2 Interior view of calorimeter box, shows appearance of radiation thermopile superimposed on the gradient thermopile. A calibration device is shown in position. The entire interior of the box is lined with identical thermoelectric receivers

Fig. 3 General view of calorimeter and associated apparatus. Constant-temperature baths are located on upper level. The heat exchanger is located behind the instrument panel



other form of heat transfer. Fig. 2 shows the checkerboard appearance of the radiation thermopile.

The voltage outputs of the two thermopiles are fed through a switch to a single-pen recording potentiometer, shown in Fig. 3. The switching can be done manually or by an automatic switch changing from one output to the other every 15 seconds.

The associated equipment shown in Fig. 3 includes a heat-exchanger and constant-temperature water tanks. These items condition the air entering the calorimeter itself and also the air entering the hollow walls in back of the gradient thermopile. The ventilation rate of the calorimeter is about 9.4 cfm. Electric hygrometers at calorimeter entrance and exit measure any moisture vapor given off by an animal.

Calibration of the gradient thermopile was done by dissipating known amounts of heat electrically and noting the millivolt response. Due account was taken of any extraneous heat gain or loss. The gradient thermopile curve plotted in Fig. 4 was made with a number of different heating devices, ranging from resistors to light bulbs.

The radiation thermopile was calibrated with the aid of a brass cylinder of known size, with heat source within, and with surface temperature known. With the surface temperature of the calorimeter interior known, radiant heat transfer can be calculated from the Stefan-Boltzmann law and related to the millivolt response. The cylinder was coated with flat black lacquer, of emissivity 0.97, close enough to animal-surface emissivity to allow reasonably good measurement of the radiation from an animal.

Fig. 5 shows the heating and cooling rate of a 200-ohm, 50-watt radio-type resistor (ceramic-coated) suddenly powered with 18 watts. These curves show slow rate of heating and cooling of such an object, and that at equilibrium over

(Continued on page 739)

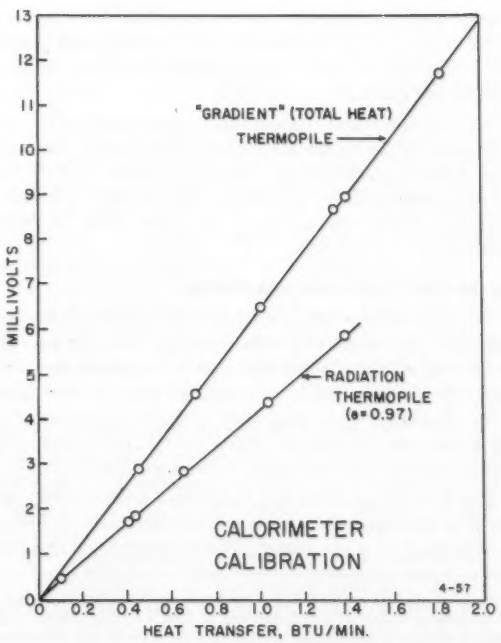


Fig. 4 Calorimeter calibration curves. Several points were plotted on each curve to illustrate the linear calibration of each thermopile

GOLDEN ANNIVERSARY FEATURE:

IMAGINEERING —

Charles E. Ball
Assoc. Member ASAE

DURING the past 50 years the electrical industry has doubled in size every decade. There is no reason to think that this doubling will not continue for a few more decades. Some experts even see the day when farm use of electricity for production purposes will be 10 times today's consumption.

This will not happen automatically, of course. It will take some planning, prodding and prophesying by farm electrification people. *It will take imagineering.* Imagineering is not fanciful dreaming. It is aggressive, daring, planning and analyzing based on sound engineering. So let's do some imagineering!

A Booming Population

The rapid increase in population is mentioned first because it means that agriculture's markets are growing. About 1952—the time of the "Fifth Plate" scare—USDA predicted that by 2,000 A.D. the United States would have 190 million people. Later they raised it to 200 million. Now the latest estimates are for 228 million by 1975! It is quite possible that in another 50 years our population will be double the present 170 million.

Can we feed them? Some folks occasionally try to create excitement by saying we are running out of land. But when *Farm Journal* celebrated its 75th Anniversary in 1952, top scientists were called in and asked, "Can we feed 200 million people?" Their conclusion: *"We can feed a billion people!"*

Key to the Photosynthesis Riddle

Photosynthesis is the process by which green plants make food out of air, water and radiant energy from the sun. *It is the basis of all life.* While man eats both animals and vegetables, the animals which he consumes must in turn subsist on the vegetable life. And until recently, plants were the only known way to convert carbon dioxide into some usable form of energy, such as sugar, protein and fat.

But a couple of years ago, California scientists were successful in manufacturing sugar from carbon dioxide without the assistance of green tissue. The application of this finding could well be the most important development of the next 50 years. According to Dr. D. I. Aanon, "This could usher in an era of unlimited abundance for the benefit of all mankind."

The first practical step might be in altering or improving the efficiency of plants. Already the California scientists have been able to triple the rate of formation of sugar in a particular plant! They also have increased the rate of protein production.

Along this line, we are sure to see a lot more use of light in plant production. While plants receive tremendous energy from the sun, it does not take much radiation to control blooming time of certain plants, thus speeding up or slowing down their development. We are just learning the importance of photoperiodism in plant growth. It is still an infant field. But what an "illuminating" field it is!

We could move the light out to the field or "bring the field into the light." Scientists at the Midwest Research Institute have proposed an "indoor farm" which would have soil moving on conveyor belts under a giant plastic canopy. The soil moves past stations for proper fertilizing, seeding, watering, etc. Under the plastic dome, temperature and light could be controlled. Insects, hail and damaging winds would be barred. Growth would be speeded so there could be several crops a year. And most of the conventional hazards of farming would be eliminated.

Interestingly, this idea was developed using the approach called "systems analysis" or "operations research." This is where a group of researchers, representing all the sciences involved, start with the finished product and figure out the various systems by which it can be obtained. They are not concerned with merely improving the present system, but are looking for fresh and entirely different systems.

New Crops, Bred for Specific Purposes

Of some 250,000 species of higher plants which have been identified, only 150 species account for most of the world's cultivated crops. There probably are dozens of plants—maybe growing in the jungles of Africa or the mountains of South America—that could be grown profitably in the United States.

New uses for present crops offer an even more immediate opportunity. Here are some possibilities listed by the recent presidential Commission on Industrial Uses of Agricultural Products:

Paper presented at the Golden Anniversary Meeting of the American Society of Agricultural Engineers at East Lansing, Mich., June, 1957, on a program arranged by the Electric Power and Processing Division.

The author—CHARLES E. BALL—is regional editor of *Farm Journal*, Dallas, Texas.

The Next 50 Years

Imagineering, as explained by the author, is not fanciful dreaming, but aggressive, daring planning and analyzing based on sound engineering. Predictions and opinions presented in this paper stem from information obtained from top leaders, industrialists, researchers, executives and others who offered what were considered as tangible and knowledgeable ideas on expected agricultural engineering developments during the next 50 years, especially in the field of electricity.

Forage crops: Our 55 million tons of legume forage harvested each year could become a multi-billion dollar industry. Such forage contains protein, carotene, vitamin E, vitamin K, xanthophyll, chlorophyll *valued at over $30 billion!* Only chlorophyll and xanthophyll are being extracted now.

Cereal grains: Each year about a million tons of additives and modifiers are used in road building. This includes rubber-like products for asphalt and moisture-proof coating for concrete. These materials might be made from grain.

Corn: A big possibility here is for a variety with 100 percent amylose starch. It would find a big market in plastics, transparent films, sizing, coatings and adhesive materials. Synthetic rubber also offers a big market for alcohol derived from corn.

New varieties especially adapted to cold or drouth areas will be developed. Take cotton for example. Some 50 to 60 percent of the plant food and over 90 percent of the moisture required by the cotton plant goes into the stalks and leaves. But since fiber and seed are of most value breeders are working toward plants that have fewer leaves, thus use water more efficiently, and can be grown with fewer or no irrigations.

These are just a few examples of new crops and new uses for old crops that may be seen in the next 50 years.

Growth Regulators for Crops

Growth regulators for crops will have a great impact on farming during the next half-century. Gibberellic acid, for example, came into the limelight this past year. It makes cabbage grow like a bean, higher than your head; makes flowers grow faster and taller; increases the fiber length of cotton; and makes tobacco plants grow bigger leaves. It's still in the experimental stage, but gibberellic acid no doubt is the forerunner of a host of chemicals that will *speed up or slow down plant growth.*

New Additives for Livestock and Poultry Feeds

The story about antibiotics and hormones (like stilbestrol) is familiar, yet better materials like these and some "unidentified factors" that make animals grow faster are likely to be discovered. We possibly will learn to grow a pound of poultry meat for a pound of feed. (It is feasible because meat contains much moisture.) Then we might even have hormones to synchronize the heat period of livestock. This would make practical for the first time artificial breeding of beef cows and hogs.

More Fresh Water

Water may become the No. 1 factor in determining industrial and agricultural growth. Industrialists estimate that needs for water will double in the next 10 to 15 years. Where will it come from?

In the first place, more reservoirs will be built to catch flood water. Then more water will be conserved in our streams and lakes. Tests with fatty alcohol films, spread on the surface, are reducing evaporation 20 to 40 percent. And since more water is evaporated from municipal lakes than is used, this can greatly increase the supply.

This, however, is not enough. We need new sources of water and the ocean is the logical place. The U.S. Department of the Interior is just winding up a $2,000,000 research project where they brought the cost of desalting ocean water down to 60¢ per thousand gallons. But that is still high. Large users of irrigation water now pay ½¢ to 2¢ a thousand gallons or $4 per acre-foot. Industry pays about 5¢ and a few cities have paid nearly 30¢ or about $100 an acre-foot.

There are a number of ways of converting saline water; all take power. The researchers say about 12 kwh per thousand gallons is the best we can hope for. This amount of power would not cost much. Perhaps someday large conversion units will be operated at off-peak periods, thus firming up the power loads for electric companies.

So it is only a matter of years—certainly within the next 50—that we will see a network of big-inch lines crisscrossing the United States and carrying desalted water, pumped by atomic or solar power, for industries, cities and possibly for irrigation.

Atomic Power That Agriculture Can Use

Since we were so dramatically introduced to atomic power, only 12 years ago, scientists and businessmen have learned a lot about it and now have a fair idea of how we can use it.

Electric power from nuclear energy, of course, is here. But the Atomic Energy Commission tells us it now would cost two to four times as much as electricity from conventional fuels. The cost of nuclear power is coming down, however, and the cost of fossil fuels is going up. In the future, possibly in 10 years, these cost curves should meet

. . . Imagineering

and nuclear power will continue to become cheaper and cheaper.

By 1970, many scientists predict that at least 5 percent of the nation's generating capacity will be atomically powered; and by 1980, this should increase to at least 20 percent. By imagineering, couldn't we conservatively predict that in 50 years well over 50 percent of our electricity will be from cheap nuclear power?

But some of the "fringe benefits" from atomic energy are even more exciting. Using by-products of atomic furnaces, for example, small batteries have been made to convert nuclear radiation *directly into electrical energy.* So far they are used only to run transistors or furnish other extremely small amounts of power—in the range of millionths up to thousandths of a watt. But these tiny batteries can run a wrist watch or hearing aid for 20 years or so.

Maybe they can be enlarged to operate small motors for a host of farm uses. Some scientists go so far as to predict that a single battery could give a house all of the electricity necessary for many years—eventually, perhaps, for a lifetime.

Portable Electricity

Some engineers feel that this introduces a new era into farm electrification. While the Electrall, introduced only two years ago by International Harvester Co., has not been widely accepted yet, it still is a new and challenging concept. If this idea were combined with an electric drive for tractors, what effect would this have on farm electrification?

Big tractors, dirt movers and land clearing machines built by R. G. Le Tourneau, Inc. are electrically driven. The diesel engine with generator can be mounted anywhere on the machine—front, rear or on one side. Only an electrical cable runs from the generator to the electric motors in the hubs of the four wheels—no transmission, no differential and no gears.

Would the same idea be practical on smaller farm tractors? It is a debatable question among tractor designers, although it appears to be the coming thing in heavier equipment. On electrically-driven tractors you already have the generator and power source. You could plug in electric motors anywhere on the farm. Or you might light up the back corner of the farm with a 25,000-watt lamp, mounted high on the tractor to harvest a crop of sweet corn or celery in the cool of the night. Some engineers feel that we'll find more uses for portable electricity, possibly in the field of weed control or plant stimulation.

Electro-Evolution in the Home

While these exciting changes are happening around the farm, some electrifying advancements will be taking place in the home, too. Researchers in this field will predict only 5 to 20 years ahead, however, based on developments already in existence. Among them:

- A freezer and electronic oven combination into which you place prepared dishes of food. At meal time, you push a button and automatically the food you desire goes from the freezer to the oven, is cooked and comes out the other side ready to eat. (General Electric Co.)
- A rotating TV monitor, that shows at a glance activity at the front door, back bedroom, farrowing house or chicken house.
- A self-propelled serving cart that detaches from the dishwashing mechanism, goes to the dining room table for dirty dishes, then returns to dispose of waste and wash the dishes.
- A "mechanical maid" that automatically scrubs the floor, waxes and polishes it. It looks like a colorful portable radio, is powered by batteries (RCA Whirlpool).

A new concept in cooling is a noiseless refrigerator with no moving parts—no motors, no fans, no pump. It operates on the theory that direct current passing through a junction of two dissimilar materials creates a cooling effect when the current moves in one direction. And it creates a heating effect when the current is reversed.

Scientists at the Radio Corporation of America visualize that rooms can be air conditioned by inserting panels of these materials in the walls. Then the same panels would be used for heating.

Also for the housewife of the next 50 years will be beautiful new lighting. Electroluminescence will light up an entire wall or ceiling. No light fixtures—the walls are light! And to suit her mood, the brightness and color can be varied by simple control knobs (Westinghouse).

Electronic Brains

Here is one of the miraculous developments of the decade—electronic data computing systems. They are symbolic of the future in electronics.

Machines in the past have mechanized physical and hand labor. But today machines are beginning to mechanize the drudgery of decision making.

According to Don G. Mitchell, president of Sylvania, "One computer can do in 15 minutes a problem of engineering design that would require one man several years to solve with a desk calculator or slide rule. . . . These machines not only will lead to greatly improved techniques but will point the way to the solution of problems that we don't even know exist."

A mathematician at Chance Vought Aircraft Inc., Dallas, Tex., reports that it took him six weeks, using a desk calculator, to solve a problem in connection with a guided missile interception. But on a new electronic brain, the same solution takes exactly 39 seconds!

Increased accuracy has permitted us to lower the safety factor from 2 to 1.1 in many cases," he continued. "In fact, it would be impossible to solve the complicated problems and design today's modern planes without the new machines."

An interesting application related to agriculture is illustrated: The Southwestern Regional Office of Commodity Credit Corporation has grain of different qualities in hundreds of different locations. The director admits that he can neither keep up with the amount on hand nor where it is located. When CCC gets an order for a foreign shipment of grain of certain quality, they start figuring what is available, what blends are practical and what the freight rates would be from the various locations (and freight rates vary greatly). The person making the decision is faced with thousands of alternatives.

Their freight and storage expenses, for the Southwestern regional office alone, run well over $100 million a year. With an electric brain, they could store up information and

know exactly the amounts, qualities, location and precisely what could be shipped and blended at the lowest cost. *This is mechanical decision making.* And the director estimates conservatively that it would cut expenses 2 percent or $2 million, and the savings could run as high as $10 million a year.

In case you are wondering if machines will be able to replace the human brain, International Business Machines Corp. scientists say they could build a replica, but admittedly with problems. The human brain weighs only 3½ lb, requires less energy than a 25-watt bulb and can remember 15 billion pieces of information.

A replica, according to these mathematicians, would fill a building larger than New York's Grand Central Station, take one billion electronic tubes, one billion relays, and more power than is consumed by the city of Washington, D. C. *And still it could do no creative thinking.*

This paper is intended to point out a few "straws in the wind" that help to suggest the fabulous possibilities that lie ahead.

It has been said that we have made more scientific progress in the last 50 years than in all previous history. And scientists tell us that many single new discoveries today remove the stumbling stones or open the door to a dozen other new discoveries. This being true, it takes real vision to comprehend where we are going. *It takes imagineering!*

. . . Heat Transfer

(Continued from page 735)

40 percent of the heat transfer is by radiation, with surroundings at about 75 F.

Curves of Fig. 5 must not be considered as indicative of the calorimeter response time. Response time of the radiation thermopile is only a few seconds, limited by the balancing speed of the potentiometer, while that of the gradient thermopile is of the order of 20 seconds.

The instrument described is a pilot-model calorimeter, the forerunner of a large (cow-sized) calorimeter planned for the future. Meanwhile it is being used for heat-transfer studies of poultry, lambs, rabbits, and rats. None of the heat sources are allowed to touch any part of the interior surfaces; therefore, conduction is negligible and all heat transferred is either radiation, convection, or evaporation.

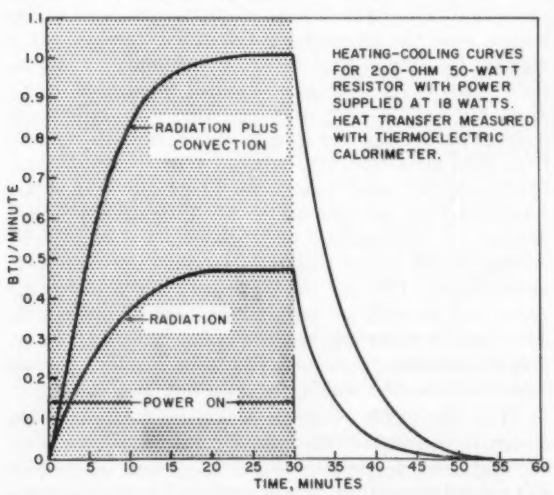


Fig. 5 Illustrating the heating-cooling characteristic of an ordinary ceramic-coated resistor. Power was suddenly applied, and, after equilibrium was reached, suddenly cut off

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Correction

SOME errors in the article, entitled "Fifty Years of Tractor Development in the USA," by R. B. Gray and E. M. Dieffenbach, as it appeared in the June, 1957, issue, have been brought to our attention. Page 393, the Yuba Co., Marysville, Ohio, should read the Yuba Manufacturing Co., Marysville, Calif., and the C. L. Best Gas Traction Co., was located in San Leandro, Calif., instead of Stockton. On page 397 the Gibson Corp. was listed as being located in Longmont, Calif., but should read Longmont, Colo.

Ag Teacher Training Committee Discusses Dairy Mechanization

A SPECIAL subcommittee of the Agricultural Teacher Training committee of ASAE, (left to right, standing) George O'Kelly, U.S. Office of Education; E. W. Foss, agricultural engineering dept., Cornell University; James Freyermuth, teacher of agriculture, Frank Anthony, agricultural educational dept., Pennsylvania State University; (seated left to right) J. P. Schaenzer, REA, Washington, D.C.; and A. A. Stone, International Harvester Co., Washington, D.C., are inspecting pamphlets prepared by G. E. Henderson, coordinator of the Southern Association of Agricultural Engineering and Vocational Agriculture. The meeting was held at the Pennsylvania State University, August 21, to discuss what teachers of vocational agriculture should teach regarding the problem of modernizing the dairy enterprise. The subject of mechanizing the dairy enterprise was chosen for discussion because it was felt that the chores of routine work around the buildings have had less emphasis in mechanization than field work, yet take up a large portion of a farmer's time.

Design Rain — Aid in Erosion Control Studies

D. B. Krimgold and Ami Shahori
Member ASAE

Rather than wait for the "once-in-10-years" runoff and erosion, the authors selected and reproduced the required rain and conditions

AFTER twenty years of work in hydrologic phases of soil and water conservation and of watershed management in the United States, the senior author was asked by the Food and Agriculture Organization (FAO) of the United Nations to assist the Israeli government in setting up erosion and hydrologic studies. It is the purpose of this paper to report on one phase of the work carried out by the authors in 1956 which should prove of interest to readers of AGRICULTURAL ENGINEERING in the United States and elsewhere.

Israel has been called "a very small country with very large problems." This is true not only geographically, politically, strategically, economically, culturally, ethnographically, and socially, but also climatically, geologically, physiographically, pedologically and hydrologically. The hydrologic facts and the erosion and water problems resulting from this combination of physical, social and economic conditions were described in a recent paper published in the 1957 Technion Yearbook(1)*.

Since its establishment in 1948 the state of Israel has received a great deal of technical assistance in various fields under the auspices of the International Cooperation Administration of the United States and of the expanded technical assistance program of FAO and other agencies of the United Nations. Numerous American scientists and engineers assisted Israel under these programs and by direct arrangements with the government and its educational, technical and scientific institutions. This is particularly true in agriculture and more specifically in the fields of soil and water.

All those who worked in Israel in these fields were impressed by the many challenging problems and by the vigor, intelligence and speed with which these problems were tackled by the Israeli government and by its technicians and administrators.

Upon arriving in Israel in November, 1954, the senior author was confronted with one of these challenging problems. One of the many paradoxes in Israel is that many of the arable parts of this "arid" country receive 600 mm (24 in) or more of rainfall per annum, *i.e.*, fully as much as eastern Nebraska and western Iowa. However, the greater part of this quite considerable rainfall usually comes in the form of a number of storms with 100 mm (4 in) or more of rain often falling within two or three days. Furthermore, this appreciable and fairly intense rainfall occurs during the coldest months, November, December, and January—before natural vegetation and unirrigated crops are developed sufficiently to protect the soil from the destructive action of raindrops and of surface runoff. In many parts of the important Sharon region, which is suitable for the production of the world-famous Jaffa oranges and of a wide variety of vegetables and other crops, these unfavorable climatic conditions are combined with a shallow sandy soil often underlain with a practically impermeable subsoil. This combination makes the well-known conservation practice of contour cultivation not only impractical but actually harmful. In these erodible soils with a limited water-holding capacity even the largest practicable contour furrows silt up and break through which results in serious erosion on this sloping, highly erodible but extremely valuable soil. The obvious solution to this problem is to give the cultivation furrows a slope great enough to carry off the excess water into well-protected waterways but not too great to produce erosion in the furrow. In order to protect the orange groves during the early stages of growth, when they are most vulnerable, and the deciduous orchards at all times the direction of cultivation and therefore the layout of the tree rows must be on a permissible grade rather than on the contour. The question is what this permissible grade should be.

The orthodox way of solving such a problem for a given soil would be to set up a series of plots or strips of various lengths with various grades of cultivation furrows and to measure the erosion long enough to determine or estimate the soil loss that is likely to be equalled or exceeded once in about 10 years. Those who conducted such experiments with natural rainfall and tried to analyze the data resulting from them know that, even after 10 years of measurement, results may be quite inconclusive. They also realize how complicated the analyses can be of the practically infinite number of combinations of amounts and intensities of natural rainfall and of concurrent conditions of the experimental areas. This and the speed with which the orange groves and orchards are being planted and with which the other land is being put into cultivation made such an approach unrealistic. Some way had to be found to produce a conclusive answer within not more than two years.

Here was a case where necessity proved once more the mother of invention. This challenge was met by first critically examining the problem and deciding what information was needed to solve it. It was concluded that since it was already established that level furrows overtop and cause excessive erosion, it would be necessary to determine not only

Paper prepared expressly for AGRICULTURAL ENGINEERING.

The authors—D. B. KRIMGOLD and AMI SHAHORI—are, respectively, consulting hydrologist, Buckhorn Farm, Woodbine, Md., former FAO agricultural officer (hydrologist) ETAP expert for Israel; and director, Erosion Experiment Station, Soil Conservation Div., Ministry of Agriculture, Rupin Agricultural Institute, Emek Hefer, Israel.

*Numbers in parentheses refer to the appended references.

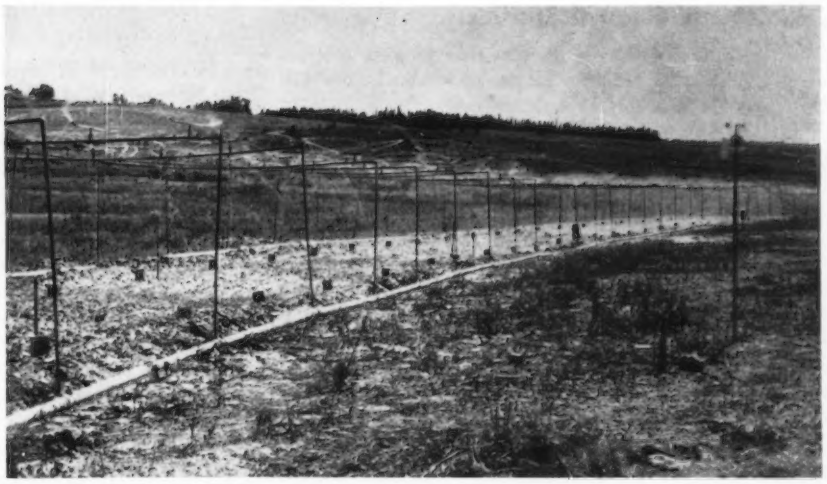

Fig. 1 The 75 mm per hr portion of the "design rain" being applied to an experimental strip 6 meters wide and 100 meters long at the Emek Hefer Erosion Experiment Station. Two recording raingages, 18 small gages and a large number of cans are used to check the intensities and distribution of the simulated rain. The anemometers indicate wind velocity. This is a calibration run. Actual tests are made at night when there is no wind and evaporation is at a minimum

the maximum permissible grades but also the minimum grades required to prevent overtopping. To be economically and practically significant, the relationship between length and grades of furrows and erosion had to be determined for combinations of rainfall amounts, intensities, and patterns, and of soil moisture conditions that are likely to occur once in about 10 years. We then reasoned as follows:

(a) With a knowledge of the water properties of the soil in question and with a 20-year record of rainfall amounts and intensities at several locations, it should be possible to arrive at a "design rain," a rain which is likely to produce the required runoff and erosion on the several experimental plots or strips.

(b) With large quantities of water available under adequate pressure at the erosion experiment station and a fairly well-developed local manufacture of irrigation pipe and sprinklers of various types, it should be possible to reproduce the design rain.

(c) With a rainless period of about seven months a large number of tests could be made in one year, and, what is most important, each test could be carried out with practically identical soil moisture conditions.

(d) The collection troughs, measuring weirs and containers for collection and measuring the bed load and the suspended load would offer no particular problem.

However, the government which in this case would have to bear the entire cost of the investigation, since the UN and FAO seldom supply any funds except the salary of the expert, might not feel justified in appropriating the funds and supplying the necessary facilities and personnel, unless it could be convinced that conclusive results would be forthcoming within two years or less.

It was therefore decided to prepare a detailed work plan containing a complete outline of the experimental procedure to be followed; a complete list of materials, labor and other facilities including the quantities of water required; a schedule of tests to be made, and a timetable including a realistically estimated date at which the results would become available. It was gratifying to find that, when this work plan involving the expenditure of some 20,000 Israeli pounds ($11,000) was presented and explained to the director of the Soil Conservation Division, we were told to proceed and were assured that the funds and facilities would be provided. The important features of the work plan included the utilization of the simplest, most inexpensive, locally available materials without sacrificing the required accuracy of the measurements.

The plan called for tests of furrows with ½, 1, 2, 3 percent grades and with lengths of 165, 330, and 490 ft. Each experimental strip was to be 20 ft wide to accommodate four furrows. Thus the largest strip was to have an area of about 10,000 sq ft, or nearly ¼ acre. With three lengths and four grades, twelve strips were required. These were laid out on an area of about 10 acres. Total quantities of water to be used in this experiment ranged up to about 86,600 gal. The rate of application for the longer strips was to be about 830 gpm.

The results obtained from these tests are shown in Table 1. Considering the soil losses shown in the table and the performance of the furrows, it was provisionally concluded that grades of furrows and of tree rows in the shallow, sandy loam soils of the Sharon region in Israel should be 1 percent with a permissible range of ¾ to 1½ percent.

TABLE 1. PROVISIONAL RESULTS OF TESTS
(All strips were 6 m wide)

Length, m	Grade, %	Soil loss (approx.)	
		mm	tons per acre
50*	2	0.65	4
50	3	1.7	10
100	½	0.15	1
100	1	0.25	1.5
100	2	0.5	3
100	3	1.35	9
150*	½	0.35	2†
150	1	0.2	1
150	2	0.7	4

*In view of the unusually consistent results for the 100-meter strip (the length most common in practice) it was not considered necessary to test the ½ and 1 percent 50-meter strips or the 150-m 3 percent strip.

†This inconsistent value may be due to improper grading and faulty installation of the collecting trough.

. . . Erosion Control Studies

It is intended to subject the data to a complete analysis, although it is quite unlikely that the above conclusions will be modified appreciably by such analysis.

Actual tests began in May, 1956, and the results and conclusions were submitted to the soil conservation division in December of the same year.

A description of the instrumentation and of the procedures used in the tests; discussions of the distribution of the simulated rain on the area and of the sizes of raindrops and a more complete analysis of the data will be included in a forthcoming scientific report on these studies. In the limited space of this paper, only the concept of the "design rain" will be discussed, as this is the key to the whole project and constitutes an important contribution to the methodology of erosion studies and of many similar investigations.

First of all, it must be realized that in practically all cases, when it is necessary to arrive at: *(a)* permissible grade; *(b)* optimum density of vegetal cover in a grassed waterway, *(c)* minimum width of buffer strip, *(d)* maximum spacing of terraces or of intercepting ditches or of contour furrows or *(e)* the required capacity of a spillway, the experimental problem resolves into testing a series of plots, strips or structures. Finding the optimum, practical and economically feasible density, width, length or size that will eliminate erosion and other damages or will keep them to a reasonable minimum is necessary. When planning large important expensive structures and practices, the failure of which involves great financial losses and even loss of life, it is necessary and economically feasible to provide for critical conditions that are likely to be encountered once in 100 years or even less frequently. For conservation practices and structures it is neither advisable nor feasible to provide for conditions that are likely to be encountered less frequently than about once in 10 years.

In spite of the great progress made in hydrology and hydropedology in the last 30 years, we are not now and probably will not for some time be able to forecast future amounts and intensities of rainfall, soil moisture and vegetal cover conditions. We therefore have no choice but to assume that what happened in the past is likely to occur in the future and must estimate future occurrences on the basis of past experience. This in effect is the basis of all planning and design involving climatic hydrologic and similar risks. Problems involving temperatures, rainfall and even streamflow on larger streams in many parts of the world are relatively simple because records of these parameters are available quite generally for a good number of years. This is not the case with respect to runoff from small catchments, soil moisture, erosion and many other important factors. We have, however, progressed sufficiently in our knowledge of soil-water-plant relationships to be able to infer fairly well at least the order of magnitude of surface runoff and of erosion from our knowledge of water properties of soils and from the other parameters for which long-term records are available. We must no longer always throw up our hands when confronted with lack of data for the specific factors involved, particularly when we remember, as we always should, that estimates of future occurrences from even long records of past experience cannot be too accurate. If this is properly understood, then one need not hesitate to use derived rather then actually measured values particularly when seeking relative rather than specific data.

It was this reasoning that led to the concept of the "design rain".

We reasoned that such a rain should consist of an initial period with an intensity equal to or somewhat less than the infiltration rate of the dry soil and an amount sufficient to bring the upper permeable layer of the soil to field capacity or above. This initial period should be followed immediately by a period of intensity and duration that can be expected about once in 10 years. Such a rain can be expected to produce sufficient erosion from the unprotected interfurrow spaces and from the sides of the furrows and sufficient depth of water in the furrows to overtop them if the grade is insufficient or to cause erosion in the furrows if the grade is excessive. A 20-year record of rainfall amounts and intensities at several locations in Israel and an analysis of these data reported by Katzanelson (2) made it possible to select such a rain. Katzanelson reported that for the highest rainfall, with durations up to 3 hr, recorded in Israel (in 20 years) the relationship between depth *(D)* and duration *(T)* can be expressed by $D=KT^n$ found by Fletcher (3) to be the equation of the envelope curves for the world record values and for the highest values for the United States north Pacific coast. The value of n in both cases as well as in Israel was practically 0.5. Interestingly enough Katzanelson reports that Rosenan of the Israel Meteorological Service and Irmayi of the Israel Institute of Technology, respectively, found that, when expressed in the same units, K for Israel is practically the same as for the north Pacific coast of the United States. Using the expression given by Katzanelson, $D=75\sqrt{T}$, we find the all-time (20-year) maximum to be about 3 in for one hour and 4.25 in per hr for 30 min. With this as a general guide the 20 highest continuous rains recorded in Tel Aviv during a 20-year period were examined. This resulted in the selection of a continuous rain with an initial 4-hour period with 1.89 in and an intensity of about ½ in per hr followed by 1.5 in in 30 min, intensity 3 in per hr, and concluded by another inch in two hours.

With an estimated water-holding capacity (field capacity minus wilting coefficient) of about 15 percent by volume, the first 1.89 in would bring the dry soil to somewhat above field capacity. The intensity of 3 in per hr for 30 min, which occurred twice in the 20-year period of record and can therefore be considered a 10-year occurrence, would produce the proper amount of runoff and erosion. The last 1 in was included to more nearly represent an actual natural rain.

Having thus selected the design storm, the next step was to design and assemble the rainfall simulator and appurtenances, the collecting troughs and the measuring equipment. Space will not permit discussion of the various problems encountered and the interesting simple and ingenious ways in which they were solved. The authors hope to include this in the scientific report mentioned elsewhere in this paper.

In conclusion, it may be well to emphasize that the concept of the "design rain" would prove helpful in many other ways. For instance, preliminary design values of surface runoff can be arrived at much sooner than normally if the proper "design rain" is selected and compared with actual rains experienced in the course of runoff studies.

Provisional results may thus be conceivably obtained even during the first or second year of record instead of waiting the customary ten years. Another way in which this concept can be profitably used is in evaluation of new methods and practices. Quite often a practice is improperly discredited or overenthusiastically recommended. This can be avoided if the experienced rain is compared with a properly selected "design rain."

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. . . Cold Spots

(Continued from page 729)

A traverse in the north-south direction under the center of each shade with a directional radiometer revealed that a large amount of solar radiation was being reflected from the *top* side of the louver boards down on to the animals. It was apparent to a person standing under the shade that there was a concentration of energy on the face and body from the *north* side. The graph of Fig. 6 indicates the relative intensity of radiation at the center of the shadow as measured under each of the three shades and in the open. It can be seen that by moving to the north end of the shade an animal would be out of the area of the reflected energy. It was noted that whenever the cattle did stand under this shade they were bunched at the north end. Increasing the shade height from 6 to 9 ft had the effect of moving the high-intensity area south, leaving a larger area at the north end free of reflected energy.

It would be possible of course to adjust the angle of the boards so that the energy would all be reflected upward. However, with every decrease of the louver angle less of the shaded area is exposed to the cold sky, and this defeats in part the purpose of this type of shade. The amount of reflected energy possibly also could be decreased by using a highly absorbent color or material for the upper surface of the louvers. In 1952 a small louver shade was constructed at Davis, with the upper side of the boards painted a dull black. Observations with the radiometer indicated no benefit from this treatment, however.

Bright Vertical Shade: A vertical wall running east and west, with the north side a perfect reflecting material, theoretically should give full exposure to the north sky and provide the same condition for the south side of the animal (because of net exchange of energy by reflection from the animal back to the north sky). The 8-ft-high, bright, Alclad-aluminum-covered surface of a small weather station shelter at El Centro was used to test this theory. At noon on August 19, 1949, a directional radiometer was set 2 ft from the north side of the building, 16 in above the ground, and a traverse was made by 10-deg intervals from the north to the south horizon. The instrument was then moved away from the wall and the traverse repeated to obtain the unshaded conditions. These data are plotted in the graph of Fig. 7. The radiosity of the north sky as reflected in the vertical wall is almost a mirror image of the north sky itself. Compared with the actual south sky, excluding the sun, the wall reflection averages at least 50 Btu per hr sq-ft lower in intensity of irradiation of the normal instrument sensing element surface. In terms of effective sky temperature, the reflection of the north sky against the wall averaged about 75 F, 45 deg lower than the average of about 120 F for the south sky. This mirror-like reflection of the north sky explains why livestock will stand in the shade of high walled buildings in preference to conventional shades. This is especially true in the case of metal buildings, which all have a high reflectivity for long-wavelength radiant energy.

The disadvantages of a vertical shade are of course the small amount of ground shadow obtained with a given amount of shade material, as compared with the shadow areas obtained under a flat shade. The area disadvantage becomes greater as the summer solstice approaches. Another disadvantage is that during the early morning and late afternoon hours the sun in some latitudes and seasons will cast its direct rays upon the north side of a building, making that area useless as a shade.

However, the principle of using a reflecting surface to multiply the effect of low-temperature areas of the surround should be considered in the design of livestock shades.

It seems to the writers that in designing livestock shelters for hot climates, agricultural engineers may not have used to full advantage the opportunities offered by radiation cooling to the sky.

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Research Seminar on Tillage and Traction Equipment

A seminar on tillage and traction equipment Research will be held at the National Tillage Machinery Laboratory and the Alabama Polytechnic Institute, October 24 and 25. The purpose of the seminar is to discuss mutual problems of public and private agencies in improving and developing equipment for soil management and to formulate methods and procedures for cooperative effort in future developments.

An outstanding program has been arranged. E. V. Smith, dean, School of Agriculture, and director, Agricultural Experiment Station, API, will talk on the role of the land grant college in agricultural research and education. T. C. Byerly, deputy administrator, production research, ARS, USDA, Washington, D. C., will speak on the importance of basic research to agriculture. Several members of ASAE will be included on the program. E. G. McKibben, director, (AERD, ARS) USDA, Beltsville, Md., will discuss plans for the National Tillage Machinery Laboratory. A paper on the purpose and history of the machinery laboratory will be presented by M. L. Nichols. F. A. Kummer will serve as master of ceremonies for the banquet Thursday evening, October 24.

A panel discussion on equipment and soil relations research needs will be led by W. M. Carleton, with topics to be presented on tillage equipment by T. L. Mullen; traction by W. H. Worthington; transport by P. J. Forrest; and trafficability by C. R. Foster. W. H. Allaway will give a paper on tillage and crops.

A tour of the machinery laboratory and an opportunity for visits or conferences among individuals or groups are planned for the afternoon sessions, respectively.

Irrigation Conference

An Irrigation Conference will be held November 14 and 15 at the Lubbock Hotel in Lubbock, Texas. The conference is sponsored by the newly-formed Texas Inter-Industry Irrigation Council and should be of interest to farmers, agricultural leaders, and the irrigation equipment industry.

One of the high lights of the meeting will be a talk by Jack Z. Anderson, administrative assistant to President Eisenhower. His subject will be on irrigation farming—a key to better living, which is also the theme of the conference. ASAE members J. F. Schrunk, A. S. Gray, R. C. Mueller, G. O. Woodward, W. D. Criddle, and I. D. Wood will appear on the program.

Topics to be presented will be on irrigation's significance; water supplies; soil, water, and plant relationships; water movement; pumps; power units; water applications; reduction of labor; costs; factors affecting surface irrigation; land leveling; economic considerations; adequate financing for irrigation economy; and others.

ECPD-EJC General Assembly

The twenty-fifth annual meeting of the Engineers' Council for Professional Development and the fourth general assembly of the Engineers Joint Council will meet October 24-25 at the Hotel Statler in New York, N. Y.

Subjects for discussions will be on the attitude survey of scientists and engineers in Government employ and in industry; a report of the third EUSEC Conference on Engineering Education and Training; the community college and technological education; the place of the engineer in management; and new dimensions in post-graduate education for the young engineer. The Silver Anniversary dinner of ECPD will be held at 7:00 p.m. in the Gold Ball Room, October 24.

ASAE members are welcome to attend. Copies of the program are available on request from ASAE Headquarters in St. Joseph, Mich.

New ASAE Section Approved

A new ASAE section for South Carolina has recently been approved by the Council of ASAE. An organizational meeting will be held November 22 at the Clemson Agricultural College, Clemson, S. C. The new section follows Iowa as the second to be formed this year.

Interest in organizing new sections grew from discussions during ASAE Cabinet Meetings at the Winter, 1956, and the 1957 Golden Anniversary meetings. J. L. Butt, secretary of ASAE, reporting before both meetings, encouraged the formation of new sections as a means for rendering better service to ASAE Members who find it inconvenient to attend national meetings.

Illini AE Silver Anniversary

The agricultural engineering department of the University of Illinois will observe its Silver Anniversary during the Homecoming weekend, October 18 and 19. ASAE president, Earl D. Anderson, will be the speaker at the Anniversary dinner in the Illini Union ballroom on Friday evening, October 18.

Open house in the agricultural engineering building and in the agricultural engineering research laboratories is planned for Saturday morning. There will be exhibits and demonstrations to show the contributions that agricultural engineers have made to agriculture in the past 25 years. Some predictions for the coming 25 years will be made also.

Prepare for "Golden State in '58" ASAE Meeting

The Arrangements Committee chairmen met on the Goleta campus of the University of California at Santa Barbara last month to start plans for the 51st Annual ASAE meeting to be held there in June, 1958. Those present were *(seated, left to right)* J. R. Tavernetti, meetings and program chairman; C. T. Rasmussen, general chairman of local arrangements; W. W. Weir, secretary of Pacific Coast Section; R. R. Parks, tours and transportation; H. Harbeson, housing manager; M. R. Huberty, meeting rooms and equipment; T. E. Bond, housing; *(standing, left to right)* D. K. Joice, housing; M. L. Adams, ladies and children's activities; L. H. Lamouria, promotion; O. Murdock, exhibits; J. F. Merson, registration; A. Rowe, catering-housing; and R. L. Perry, Pacific Coast Section program arrangements

EVENTS CALENDAR

October 17-19 — *National Society of Professional Engineers,* Grand Pacific Hotel in Bismarck, N. D.

October 24-25 — *Engineers General Assembly,* a combined meeting of Engineers Joint Council and Engineers Council on Professional Development, at the Statler Hotel, New York, N. Y.

October 31—November 1 — *Southern Farm Equipment Manufacturers, Inc.* meeting held at Radium Springs, Albany, Ga.

October 31—November 2 — *Conference on higher education in technology,* held by the Engineering Manpower Commission of Engineers Joint Council, Scientific Manpower Commission, National Science Foundation and National Research Council, Edgewater Beach Hotel, Chicago, Ill. The purpose of the meeting is to update manpower need and engineering education; to promote industry action; to focus engineers' own attention on education; to make engineers' point of view felt by the nation.

(Continued on page 772)

C. B. RICHEY

C. T. O'HARROW

R. L. ERWIN

JOHN S. NORTON

The following ASAE members have received promotions in the Tractor and Implement Division of the Ford Motor Co., Birmingham, Mich. **C. B. Richey** has been promoted to chief engineer in the research engineering dept.; **C. T. O'Harrow** has been named chief tractor engineer in charge of the tractor engineering dept.; and **R. L. Erwin** has been appointed manager of the engineering administration and services dept.

Mr. Richey has been a research engineer in the former general engineering dept. He joined Ford Tractor Division in 1953 after a six-year association with Dearborn Motors Corp. Previously he had been with Harry Ferguson Inc., Detroit, and head of the development dept. of Electric Wheel Co., Quincy, Ill. From 1936 to 1941 he was an instructor in farm power and machinery at Purdue University, and assistant professor in the agricultural engineering dept. of Ohio State University from 1941 to 1943. He is a graduate of Iowa State College and of Purdue University. Mr. Richey is national vice-chairman of the Power and Machinery Division of ASAE.

Mr. O'Harrow has been assistant chief tractor engineer. He joined Tractor and Implement Division in 1954, after 18 years with Allis-Chalmers Mfg. Co. where he had been assistant chief engineer. From 1928 to 1936 he was with John Deere Waterloo Tractor Works where he served as chief experimental engineer and assistant chief inspector. He attended Iowa State College.

Mr. Erwin has been project engineer in the former general engineering dept. in charge of development of an experimental tractor powered by a free piston turbine engine. He joined Ford Tractor Division in 1953 after five years with Dearborn Motors Corp. Prior to that he was assistant agricultural engineer at the Ohio Agricultural Experiment Station, Wooster. Earlier he had been research consultant at the Ohio State University Research Foundation. He graduated from Ohio State University in 1941.

Ernest W. Walpole has accepted the position of assistant manager, agricultural dept., Masonite Corp., Chicago, Ill. He was formerly employed by Weyerhaeuser Sales Co., St. Paul, Minn., as an agricultural engineer.

Edwin L. Miller, former field engineer with the Standard Oil Co. of Ohio, has accepted a position with the Capital Equipment Co., Lansing, Mich., as sales manager.

William E. Rohaly, formerly design engineer with the advanced engineering department of the International Harvester Co., Chicago, Ill., has accepted a position as engineer in the engineering and manufacturing department of the Hales and Hunter Co., Chicago.

John S. Norton, formerly assistant agricultural engineer with the University of Florida has joined the staff at the University of Massachusetts. He is located at the Massachusetts Experiment Station at East Wareham where he is the agricultural engineering member of a team representing the various technical areas involved in cranberry production and processing.

Mr. Norton received a B.S. degree in agricultural engineering from Pennsylvania State University in 1948. From 1948 to 1950, he was on the staff of Louisiana State University and earned an M.S. degree in agricultural engineering. After leaving Louisiana State University in 1950, he served a short time with Hawthorne, Inc. working on grain and rice driers. He joined the agricultural engineering department at the University of Florida in December, 1951 and served as assistant professor working with irrigation and strawberry mechanization.

Pierre J. Jutras has accepted a position as assistant agricultural engineer with the Citrus Experiment Station in Lake Alfred, Fla.

A. Clayton Rogers, Jr. has been appointed as district manager of the Wetumpka Division of the Alabama Power Co. He graduated from the Wetumpka High School in 1940 and joined the power company force in 1941. He held positions in Birmingham, Montgomery and Anniston, before spending four years in military service. The greater part of his work has been in the company's rural division in agricultural engineering, rates and surveying.

John R. Davis, formerly assistant professor of agricultural engineering at Purdue University in charge of teaching and research in soil and water, has accepted a position as acting associate professor in the irrigation department at the University of California at Davis. His work will involve teaching and research on irrigation methods and related water application problems.

John B. Caton has accepted the position of general sales manager for Rilco Laminated Products, Inc., at St. Paul, Minn. He was formerly in Janesville, Wis.

Edward C. Rodriguez, Jr., formerly safety supervisor with Shell de Venezuela, Ltd., has accepted a position as engineer in charge of production planning with Tri-Pak Machinery Service, Inc., Harlingen, Texas.

James E. Middleton has joined the Irrigation Experiment Station at Prosser, Wash., as an assistant agricultural engineer. Previously he was employed as irrigation engineer with Miller & Poston Mfg. Co., Spokane, Wash.

Harry P. Bateman, assistant professor of agricultural engineering, University of Illinois, has been granted a leave of absence to take graduate work at Purdue University.

William Q. Roesler, agricultural sales engineer for Goodyear Tire and Rubber Co., has been transferred to Moline, Ill., where he will serve farm implement manufacturers in the area. He was agricultural V-belt engineer at Goodyear's Lincoln, Nebr., Industrial Products plant.

He joined the Akron rubber firm in 1927 as a messenger and was gradually promoted until in 1938 he was assigned to the V-belt department and later became a field contact man for mechanical rubber goods design. He became senior contact engineer in 1948. He has been employed at the Lincoln, Nebr., plant since 1950.

Gilbert L. Corey has been appointed associate professor and irrigationist at the University of Idaho. He is a graduate from Colorado A & M College and has worked as an irrigationist at the University of Idaho branch station at Aberdeen. He has just completed a two-year assignment with the University contract program under ICA at Ecuador, S. A.

Mr. Corey will handle the teaching and research work in the general field of irrigation and conservation at the University.

Llewellyn M. K. Boelter, dean of engineering, University of California, will receive the Annual Medal of the American Society of Mechanical Engineers during the ASME meeting December 4. The medal is awarded to a person who has rendered distinguished service to engineering and science.

He was cited for "his outstanding contributions . . . as engineer and educator." Mentioned was the fact that he led in the preparation of the book "Heat Transfer," now said to be considered a standard text in English-speaking countries. His new ideas in engineering education at both the graduate and undergraduate levels were also mentioned.

Born in Minnesota, Mr. Boelter received the Bachelor's and Master's degrees in engineering from the University of California. He continued there as teacher and researcher, becoming associate dean in 1943, prior to his appointment as chairman of the department of engineering and dean of the Engineering College. This year Purdue University awarded him an honorary degree as Doctor of Engineering.

Edward A. Karath has resigned as staff engineer with the Iowa Natural Resources Council, Des Moines to accept a position with Dodson, Kinney and Lindblom, consulting engineers, in Columbus, Ohio. His principal duties are to assist in certain hydrologic investigations being made in the Ohio River Basin.

Iowa Section

The first regular meeting of the newly organized Iowa Section of ASAE will meet October 18 at Vic's Tally-Ho Restaurant, Des Moines. Registration will begin at 6:00 p.m. followed by a dinner at 6:45. The program will include a paper on problems in the design and operation of forage harvesting machinery, by G. Russell Sutherland, John Deere Ottumwa Works; and a paper and movie on oil seals, application and manufacture, presented by the Chicago Rawhide Mfg. Co.

Pennsylvania Section

A meeting of the Pennsylvania Section will be held October 17-18 at the Gettysburg Hotel in Gettysburg, Pa. Tours of Gettysburg Battlefield will be conducted after registration Thursday morning, October 17.

The afternoon program will be opened by Ralph Patterson and announcements will be made by L. D. Kimmel. Speakers representing the producer, the marketing agency, the equipment manufacturer, and research and engineering, will present a panel discussion on what is needed to make mechanical cooling of eggs pay. Papers will be given on a 20-hp single phase motor, by B. Parker Hess; milk cooling in bulk tanks under farm conditions, by Paul Anderson; steel buildings in agriculture, by Peter C. Coates; hay in a day, by James Stere; and bunk feeding in Northern Pennsylvania, by William S. Brannaka.

A banquet will be held at 7:00 p.m. with H. L. Consley as guest speaker. His topic will be on a desk hand hunting polar bears on Arctic ice.

Friday morning, October 18, papers will be presented by W. C. Stephens on agricultural engineers in sales; W. A. Mathison, Jr. on opportunities for agricultural engineers with small manufacturers; Frank Brower on the Soil Conservation Service program in Pennsylvania; and C. M. Voss, Helicopter International Corp., will speak on helicopters in pesticide application. A business meeting will close the morning session.

The afternon will be devoted to a demonstration of crop dusting with helicopter and a tour of the C. H. Musselman Co., Biglerville, Pa.

Michigan Section

The Michigan Section will meet Saturday morning, Oct. 19, in conjunction with the second annual Engineering Alumni Reunion at Michigan State University, East Lansing. D. P. Brown, vice-chairman of the Michigan Section, will preside. Following a welcome to alumni by A. W. Farrall, papers on why professional registration, the use of univac in determining water surface profiles, and implications of gibberellic acid in agricultural engineering, will be presented, respectively, by Dwight Kampe, Huson Amsterburg, and S. W. Wittwer. A business meeting will close the session.

Chicago Section

A meeting of the Chicago Section will be held October 21 at the Western Society of Engineers Building, 84 E. Randolph St., Chicago, Ill., 6:30 p.m. The selection of officers for 1958 will be made during the business meeting.

The speaker for the program will be S. S. DeForest, associate editor of *Successful Farming*. His subject will be on materials handling equipment for corn belt farms, showing how farmers are removing the backbreaking drudgery from chore-time and speeding the handling of feed, in and out of storage. This subject is of direct concern to most agricultural engineers. It is playing an increasingly important role in farm building design, in the use of electricity on farms, in the design and sale of farm elevators and blowers, and influencing harvesting machinery and harvesting methods. His talk will be illustrated with pictures taken of materials handling operations and methods, as they are done on farms throughout the corn belt.

ASAE MEETINGS CALENDAR

October 17-18 — ALABAMA SECTION meeting, Decatur, Ala.

October 17-18 — PENNSYLVANIA SECTION, Gettysburg Hotel, Gettysburg, Pa.

October 18—IOWA SECTION, Vic's Tally-Ho Restaurant, Des Moines, Iowa

October 19—MICHIGAN SECTION, Michigan State University, East Lansing.

October 21 — CHICAGO SECTION, Western Society of Engineers Building, 84 E. Randolph, Chicago, Ill.

October 23-27 — PACIFIC NORTHWEST SECTION, Compton Union Bldg., State College of Washington, Pullman

November 8-9 — OHIO SECTION, University of Ohio, Columbus

November 15-16 — VIRGINIA SECTION, Blacksburg.

December 6 — OKLAHOMA SECTION, place not announced.

December 15-18—WINTER MEETING, Edgewater Beach Hotel, Chicago, Ill.

February 3-5—SOUTHEAST-SOUTHWEST SECTION meeting, Little Rock, Ark.

March 28-29 — ROCKY MOUNTAIN SECTION, Engineering Center, Colorado State University, Fort Collins, Colo.

June 22-25 — 51st Annual Meeting, Santa Barbara Campus, University of California, Santa Barbara, Calif.

NOTE: Information on the above meetings, including copies of programs, etc., will be sent on request to ASAE, St. Joseph. Mich.

North Atlantic Section

The following were elected officers of the North Atlantic Section of ASAE for 1957-58: Chairman, Frank W. Peikert, Pennsylvania State University; vice-chairman, A. M. Best, New Holland Machine Co.; secretary-treasurer, Arthur G. Fox, New England Electric System; and chairman of the nominating committee, Mark Singley, Rutgers University.

Washington, D. C. Section

The Washington, D. C., Section has scheduled a luncheon meeting for the second Friday of each month from September to June inclusive, except during December.

James L. Shotwell, special assistant to the deputy assistant commissioner, Office of Engineering, Bureau of Public Roads, spoke on the federal highway program at the October 11 meeting.

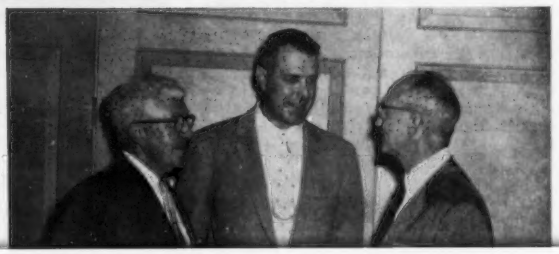
Pacific Coast Section

A meeting of the Pacific Coast Section of ASAE will be held in the Chemistry-Geology Building at the University of California, Los Angeles, January 30-31.

Any suggestions for speakers or for topics may be sent to R. L. Perry, 2066c Engineering Building, University of California, 405 Hilgard Ave., Los Angeles 24, Calif., before December 1.

ASAE Publications Display

(Above) An attractive display of the publications and literature furnished by ASAE was prepared for the 33rd annual meeting of North Atlantic Section in August at University of Delaware



(Right) Larry F. Livingston, 29th president of ASAE *(left)*, discusses events with Frank W. Peikert, new section chairman *(center)*, and Dr. Carl J. Rees, provost of University of Delaware. Mr. Livingston was featured speaker at the annual banquet on the topic "Agricultural Engineering — Then, Now and Tomorrow"

Following are brief reviews of papers presented at ASAE meetings or other agricultural engineering papers of which complete copies are available. Information concerning copies of these papers may be obtained by writing to the American Society of Agricultural Engineers, St. Joseph, Mich.

Asphalt Roofing, by James L. Strahan, technical director, Asphalt Roofing Industry Bureau, New York, N. Y. Paper presented at the Golden Anniversary Meeting of ASAE in East Lansing, Mich., June, 1957, on a program arranged by the Farm Structures Division. Paper No. **57-79.**

The adaption of asphalt roofings for a broader usefulness under widely varying service conditions has recently been extended to include low slope roof decks heretofore not considered feasible for shingle products, and also to use in areas where wind hazards have extended to limit successful performance because of the flexible character of the product. Newer shingle designs and application techniques which have during the past 5 to 10 years practically nullified the effects of high winds, are described and discussed.

The Deer Creek Erosion Control Project, by Leo S. Terbush, DPWO Eighth Naval District, New Orleans, La. Paper presented at the Golden Anniversary meeting of ASAE in East Lansing, June, 1957, on a special program arranged by the Soil and Water Division for Public Lands and Public Works. Paper No. **PL-29.**

This paper describes erosion control methods used at U.S. Naval Ammunition Depot, McAlester, Okla., for the protection of warehouses, roads, railroads, power, and water lines on a portion of the depot area. Structures including a small flood water detention reservoir for the reduction of peak flows are described. The paper explains how vegetative erosion control was established by planting bermudagrass sprigs, for rapid coverage, overseeded with native grasses for permanent low maintenance costs. All plantings were protected during the period of early growth by asphalt anchored hay mulch.

Poultry Housing in the Northeast, by A. D. Longhouse, head, agricultural engineering department, West Virginia University, Morgantown. Paper presented at the Golden Anniversary Meeting of ASAE in East Lansing, Mich, June, 1957, on a program arranged by the Electric Power and Processing Division. Paper No. **57-61.**

This paper describes a research program in the Northeast region which covers nearly every phase of poultry housing. Much of the research is conducted in special types of houses which include solar, windowless, and stress-skin (low-cost) houses. Special facilities have been constructed either within a room or the rooms have been rebuilt within existing structures. The paper reports on calorimeter work at Beltsville, Md., which could be included in the category of special housing, and on bird density investigations underway in other places. Other studies include vertical roosting, and watering and feeding over mechanically cleaned pits.

Housing and Operation Studies on California Egg Farms, by Samuel A. Hart and Thayer Cleaver, assistant agricultural engineer, and agricultural engineer (AERD, ARS), USDA, respectively, agricultural engineering dept., University of California, Davis. Paper presented at the Golden Anniversary Meeting of ASAE in East Lansing, Mich., June, 1957, on a program arranged by the Farm Structures Division. Paper No. **57-69.**

Time and travel studies were made on the housing and operation of 27 selected egg farms in California where the hens were confined in cages, wire pens, or on litter. The objectives and findings are included in this paper. The study was made to compare the labor requirements as a function of the house type, to measure the labor requirements for the chores done on a poultry farm, and to measure the effect of mechanization of the chores.

The author reports that on a per egg basis, the time and travel requirements were nearly the same on all three types of farms except when mechanization or special methods were used; the major chores of feeding, egg gathering, and egg processing took about two-thirds of the daily chore time; and a 60-percent reduction in feeding labor requirements was found on mechanized farms.

Review of Research on Equipment for Effective Seeding Practices, by E. B. Hudspeth, Jr., and W. C. Hulburt, agricultural engineers (ARS, AERD), USDA, respectively, Bushland, Texas, and Beltsville, Md. Paper presented at the Golden Anniversary Meeting of ASAE in East Lansing, Mich., June, 1957, on a program arranged by the Power and Machinery Division. Paper No. **57-106.**

This paper is not a complete review of all research seeding practices, but a progress report of some recent developments in cotton, grassland, sugar beets and cannery peas. Planting studies on cotton are discussed as carried on under the Regional Cotton Mechanization Project. Improved methods and techniques of establishing grassland are presented. Examples are cited as to types of soil and weather conditions which require different methods and equipment for planting.

Efforts in sugar beet planting to improve metering, germination and emergence, and the contributions of research workers in the development of seed furrow openers, seed tubes, press wheels, and seed metering devices that are now being used on sugar beet planters, are discussed.

A study that has been initiated by two large implement companies in cooperation with the Technical Advisory Committee of the National Canners Association to improve planting equipment for vegetable crops is outlined. The paper reports that the results of studies to determine the basic requirements of seed for water, oxygen, and heat energy may soon supply information that can be applied to planter design.

A Report on the First International Congress on Farm Buildings Research, by Wallace Ashby and Edward G. Molander, head, farm buildings section, and senior agricultural engineer, respectively (ARS, AERD), USDA, Beltsville, Md. Paper presented at the Golden Anniversary Meeting of ASAE in East Lansing, Mich. June, 1957, on a program arranged by the Farm Structures Division. Paper No. **57-83.**

This is a report on the First International Congress on Farm Buildings held at Lund, Sweden, October, 1956. Fifty-four delegates from 14 countries of Northwest Europe, the British Isles, Iceland and the United States met and exchanged information and ideas on farm building problems of common interest to these countries.

The USDA engineers noted the amount of valuable information on farm building problems that has been accumulated in other countries through research, but because of language difficulties, little of the information is available to researchers in this country. They have recommended that facilities be developed for translating into English technical reports covering several phases of agricultural engineering research.

The International Congress made great strides in promoting good will and in encouraging the future exchange of ideas among agricultural engineers and architects, according to the authors.

The Engineer and Soil and Water Conservation in Foreign Countries, by O. W. Israelsen, professor emeritus, Utah State Agricultural College, Logan. Paper presented at the Golden Anniversary Meeting of ASAE in East Lansing, Mich., June, 1957, on a joint program arranged by the Soil and Water Division with the Public Lands and Public Works Group. Paper No. **57-101.**

The author's work and observations of irrigation and drainage projects in India, Iran, Iraq, Africa, and Holland during 1955 and 1956 are included in this paper. It shows that there has been real progress in conservation. However, the urgent needs for continued development of irrigation projects and facilities; together with adequate provisions for drainage of irrigated lands in several countries are outlined in the paper and emphasized.

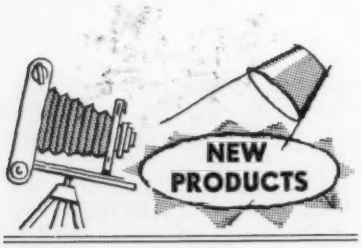
The century-old Ganga Canal in Uttar Pradesh India, having a capacity of 10,500 cu ft per second, length of 400 miles, and irrigated area of 1.5 million acres, is of particular interest. Problems of Iran irrigation projects in the southwest near the Persian Gulf are reviewed. Reclamation progress in Iraq near Baghdad is mentioned briefly.

A report on the International Commission on Irrigation and Drainage and the Irrigation Practices Seminar held in Izmir, Turkey, is included.

The Soil Mechanic Fundamentals of Pressure Distribution and Soil Compaction, by Walter Soehne, doctor engineer, Institute for Soil Cultivation, Agricultural Research Center in Voelkenrode, Brunswick, Germany. Paper presented at the Golden Anniversary Meeting of ASAE in East Lansing, Mich., June, 1957, on a program arranged by the Power and Machinery Division. Paper No. **57-104.**

In this paper the author reports on the methods of calculation and results of pressure distribution in the soil under tractor tires and those of agricultural machinery and on the measurement of soil compaction depending on the pressure at different water contents by static and kneading compaction. He also reports that it may be possible to diminish the soil damage by the right choice of suitable tire dimensions by reduced tire internal pressure.

Results from these investigations show that the possibilities of the designer of tractors, machinery and tires are limited, and that the farmer should use his equipment properly to avoid damage to soil.



90-inch Rotary Cutter

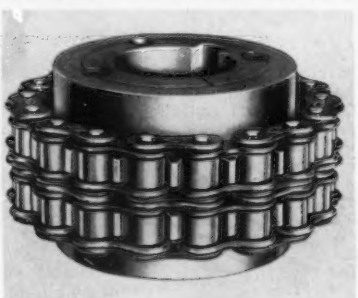
The Lilliston Implement Co. has introduced a new lift-type rotary cutter that combines a full 90-in cut with speed and maneuverability. The manufacturer reports that it can be used with any major make of tractor.

Features include a new gear box with a rating over 40 hp. A 1½ in. overlap is provided between the three pairs of high carbon, heat treated steel blades with all three spindles affixed to the same frame. New design permits fast and easy adjustment of the V-belt drive. Rounded radius skids are interchangeable.

(For more facts circle No. 51 on reply card)

Taper-Bushed Flexible Shaft Couplings

Diamond Chain Co., Inc., has introduced new steel double roller chain shaft couplings with interchangeable taper bushings. The taper bushings are supplied with bores in increments of 1/16 in. Couplings can be installed on shafts and are said to absorb moderate end play and misalignment, provide long service, and can be coupled and uncoupled by the removal of a single roller chain connecting pin.



(For more facts circle No. 52 on reply card)

Ceramic Nozzles and Fiberglas Tanks For Sprayers

Hanson Equipment Co. has introduced ceramic nozzles for agricultural boom sprayers and fiberglas tanks for chemicals on agricultural sprayers. The ceramic nozzles are said to retard corrosion and abrasive action, thereby extending operating life and maintaining the spray pattern originally designed for the nozzle, over longer periods of time.

Capacities of 2½ and 5 gal per acre will be available first, to be followed by larger sizes. These new nozzles are interchangeable with older metal types, it is said. The fiberglas tanks are made of laminated construction. In addition to high resistance to corrosion, the tanks are said to weigh less than steel or aluminum tanks of similar capacities. Tank walls are translucent, so the liquid level inside can be seen.

(For more facts circle No. 53 on reply card)

New Tractor Lights

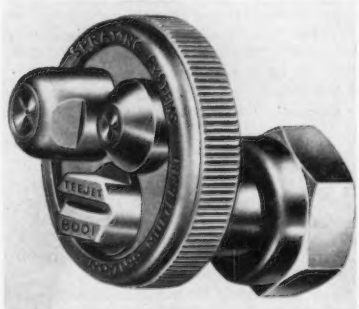
General Electric Co., Miniature Lamp Dept., has announced the introduction of two new PAR-46 all-glass sealed-beam lamps said to meet the illumination requirements of farm tractors. No. 4019 is for 6-volt circuits while No. 4419 is for 12-volt circuits.

When mounted in available housings at each side of a farm tractor cowl, just ahead of the steering wheel, and directed downward and at an angle, they reportedly spread enough light to illuminate two rows of corn on each side of the vehicle center line. The lens is designed so that the lower part of the beam is directed downward for seeing the implements suspended beneath the tractor and the work being done, while the top part of the beam projects light for seeing well ahead.

(For more facts circle No. 54 on reply card)

New Adjustable Sprayer Nozzle

Spraying Systems Co. has announced its new No. 7199 Multeejet tip assembly for use with portable spraying equipment. The new nozzle is adjustable to give choice of flat spray, solid stream or cone (misting) spray.



With this new nozzle assembly, the user can obtain three basic types of spray patterns that normally are required in spraying. The turret head indexes to each of three positions. The new tips are made in brass with brass orifices or in brass with stainless steel orifices.

(For more facts circle No. 55 on reply card)

All-Steel Pole Barn

Stran-Steel Corp., Unit of National Steel Corp., has introduced a new "do-it-yourself" all-steel pole-type farm or ranch building.

The new structural line, called the Stran-Master, comes in a wide range of sizes and can be used for livestock feeding shelter, loose-housing dairy barn, machinery storage, general utility or even as a small all-purpose shed.

No cranes or heavy equipment are needed for erection. There are no nails or spikes to be driven; all framing connections are made through factory-drilled holes by bolting. Erection is aided by a self-leveling adjustable telescoping arrangement of the steel columns. After the columns are placed in the ground they can be adjusted to correct construction irregularities and then secured with locking nuts. Concrete is poured into the hole around the base of the column and also into the column cavity (further locking the adjustment). There is also a sliding girt arrangement which helps speed up erection. Handy paper forms are provided for pouring concrete bumpers around columns for livestock housing.

The new building comes in widths of 12, 24, 36, 48, 60, and 72 ft, and in lengths of any multiple of 16 ft. Windows and doors can be installed in side or end walls. It can be ordered with any or all walls open. A low down payment finance plan is offered by the manufacturer.

(For more facts circle No. 56 on reply card)

Build-It-Yourself Portable Poultry Shelter

Aluminum Company of America has designed a new low-cost, do-it-yourself portable poultry shelter which will house 60 to 90 fowl. The canopy roof of corrugated aluminum sheet is said to provide 15-deg cooler summer temperatures, while retaining warmth during winter months. A full, upright door and angle interior head clearance are provided. Plans for building the shelter may be obtained by using reader request card.

(For more facts circle No. 57 on reply card)

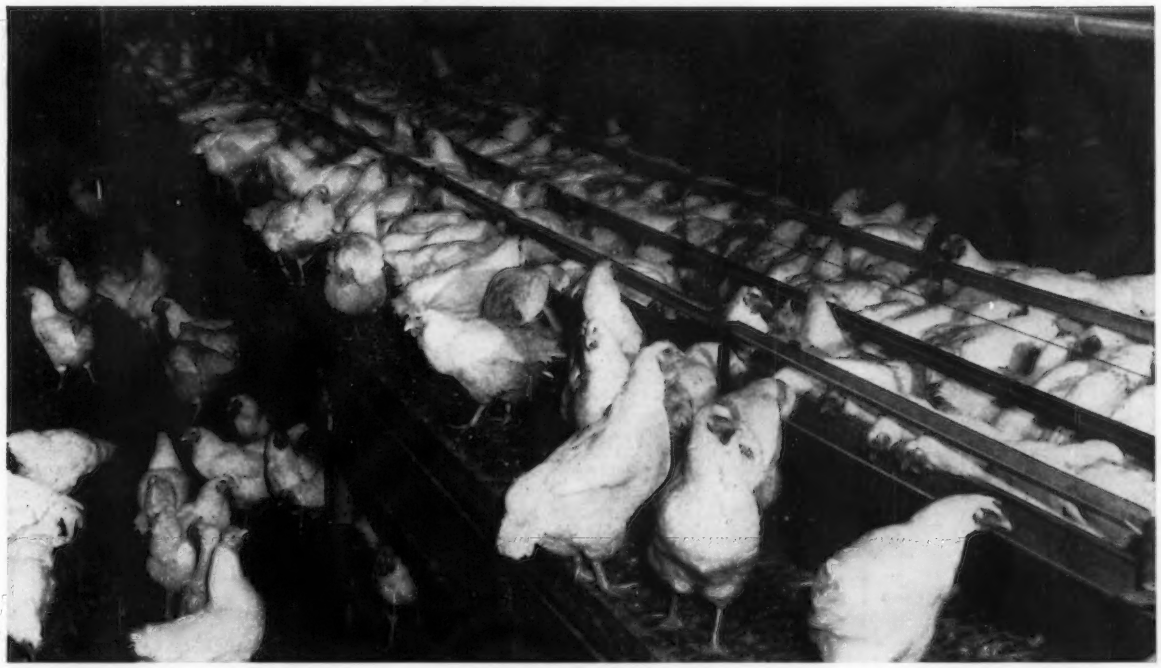
New Clear-Span Steel Buildings

Armco Drainage & Metal Products, Inc. has introduced a line of all-steel industrial and commercial buildings in clear-span widths up to 100 ft. A new plant at Middletown, Ohio, has been dedicated to produce the new product. The plant building itself is a prototype for the new line. Added to its present line of industrial, commercial, and farm buildings, the new product is said to give the company five basic kinds of buildings in more than 5,000 sizes.

(For more facts circle No. 58 on reply card)

(Continued on page 750)

Armco ZINCGRIP Steel Provides Design Freedom, long service life



Thousands of layers eat daily from these mechanical feeders made of Armco ZINCGRIP Steel. Fabrication requires severe bends, but there is no flaking or peeling of the zinc coating.

In an effort to beat the "cost-price squeeze," farmers are turning more and more to mechanization. And they want the mechanical equipment they buy to operate at peak performance.

This is why one large manufacturer of mechanical feeders for chickens makes the trough, reel, and supporting frame of Armco ZINCGRIP® Steel.

COATING ADHERES TIGHTLY

By designing with Armco ZINCGRIP, this manufacturer's engineers have complete freedom to develop a product that will do the best job. The protective hot-dip zinc coating on this special steel won't flake or peel during severe drawing or forming. In fact, the zinc coating on Armco ZINCGRIP Steel takes anything the steel base will take.

Because this coating remains intact, the zinc gives unbroken rust protection to the base metal.

WRITE US

For a catalog on Armco ZINCGRIP Steel, just fill in and mail the coupon on this page.

Armco Steel Corporation
1977 Curtis Street, Middletown, Ohio
Send me your catalog on Armco ZINCGRIP Steel.

Name_____
Title_____
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Golden Anniversary 1907 ASAE 1957
AMERICAN SOCIETY OF AGRICULTURAL ENGINEERS

Armco Steel Corporation

1977 Curtis Street, Middletown, Ohio

SHEFFIELD STEEL DIVISION • ARMCO DRAINAGE & METAL PRODUCTS, INC. • THE ARMCO INTERNATIONAL CORPORATION

ARMCO®

For more facts circle No. 8 on reply card

. . . New Products

(Continued from Page 748)

New 2-Plow Tractor

The Oliver Corp., has introduced a new Model Super 44 tractor in the small tractor class. According to the manufacturer the new model will have full 2-plow power and handles both 3-point hitch conventional drawbar and implements plus centrally mounted cultivating equipment. In addition

to the internal hydraulic system providing both draft and depth control for 3-point hitch tools, the new tractor has two external cylinders for completely independent control of both sides of the cultivators. Features include a 140-cu-in-displacement engine with automotive-type key starter, a transmission of one reverse and four forward speeds, plus tread adjustments from 40 to 68 in.

(For more facts circle No. 59 on reply card)

Weather Protected Engine

Kohler Co. has introduced its new model K660G engine which features a weatherproof steel housing. The engine is designed especially for industrial and agricultural ap-

plications where protection from the weather is important. The new model is a 4-cycle, air-cooled unit with two opposed cylinders and is said to develop 24 hp at 3200 rpm. Weight of engine and tank is 280 lb.

(For more facts circle No. 60 on reply card)

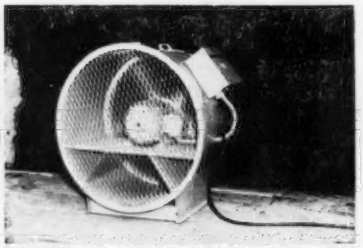
New Watthour Meter

General Electric Co. has announced a new single-phase watthour meter with a stator design said to permit "on-line" accuracy up to 200 amp. Called the I-60, it is a 30-amp, 240-volt, three-wire single-phase model, with an overload capacity of 667 percent. In the new stator, the conventional combined voltage and current electromagnet is replaced with a pair of magnetically-isolated electromagnets, one for voltage and one for current.

(For more facts circle No. 61 on reply card)

Introduces New Fan

New Holland Machine Co., has introduced a new direct-driven fan said to have low power requirements. Conversion to a fuel heat operation can be accomplished by hooking a heating unit to the fan. Powered



by a 5-hp, single-phase motor, the 36-in, 5-blade fan reportedly can handle as much as 50 tons of hay or 3,500 bu of grain at one time. The motor is totally enclosed and has sealed ball bearings. A built-in automatic safety device protects the motor against overload.

(For more facts circle No. 62 on reply card)

2-Row Mounted Picker

International Harvester Co., has announced a new model 2-MH 2-row mounted corn picker. Features include a 24-in lift for gatherers and center divider, two-hour mounting time, on-the-go snapping roll adjustment, and a ladder and deck for operator safety and convenience. Long and gradually

sloped gatherers, high and close fitting gathering sheets, and streamlined center divider for handling weak-shank and down corn are other features. Hydraulically operated gatherers and divider raise and lower, independently; consequently, the elevator and back of the picker do not drop when gathering points are raised.

(For more facts circle No. 63 on reply card)

Fiber Mat Protects Draintile

L. O. F. Glass Fibers Co. has reported a new application for porous glass fiber mat.

The product involves the use of glass fiber mat as a covering for farm draintile.

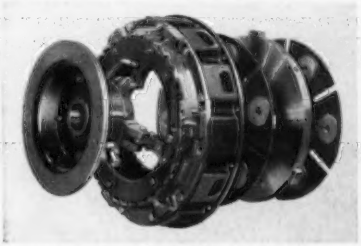
The thin, but strong bonded mat of inert glass fibers is said to withstand underground alkalies and acids that cause such conventional coverings as straw, corncobs, sawdust and other organic materials to rot and lose their protective quality.

The glass fiber mat reportedly is porous enough to permit the passage of water, but restrains most soil particles.

(For more facts circle No. 83 on reply card)

New Double-Plate Clutch

Rockford Clutch Division of Borg-Warner Corp. has developed a new double-plate clutch which is said to double, and in some cases even triple, torque provided by single-plate clutches with plates of the same diameter. Other features reported are in-



creased service life (without adjustment or plate replacement) and more heat resistance. A brake plate is mounted on the heavy-duty ball bearing type release sleeve.

Used in large crawler type tractors and other heavy-duty machines, the new clutch is designed to provide added torque with less clutch size.

(For more facts circle No. 84 on reply card)

New Electric Sets

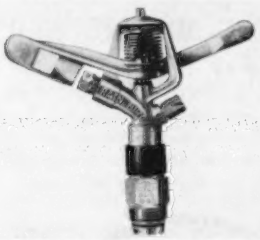
Caterpillar Tractor Co., has announced production of three new portable diesel electric sets each equipped with a new, compact generator. The D311 electric set is said to develop 30 kw of 60-cycle, 3-phase current, while the D315 (series G) set is rated at 40 kw, and the D318 (series G) set at 60 kw.

These highly mobile units are available either skid-mounted or with running gear, and the output of their self-regulated, constant-voltage generators furnishes a choice of 120, 240, 120/208 or 480-volt current at 1800 rpm. Standard equipment on the sets includes 24-volt, 18-amp charging generators and 24-volt, 170 amp-hour battery sets. The power units also come equipped with 24-volt direct electric starting, wrap-around bases, control panels and water temperature-oil pressure safety shut-offs.

(For more facts circle No. 85 on reply card)

Sprinkler Designed for Wear

National Rain Bird Sales & Engineering Corp. has introduced a new wear-resistant irrigation sprinkler called Rain Bird Model



No. 30-TH. The new two-nozzle sprinkler is designed to resist abrasive silt and sand.

Wearing surfaces of the brass bearing in the sprinkler are protected by a quickly replaceable wearing ring insert made of a wear-resistant plastic. This bearing insert forms a seal against sand and other abrasive elements. Wear is absorbed by the easily-replaced, low-cost inserts. The top of the bearing is protected from blow sand and other abrasives by a hood around the outside of the sprinkler bearing. A single nozzle model is available.

(For more facts circle No. 86 on reply card)

TWO GREAT NAMES IN ORIGINAL EQUIPMENT...

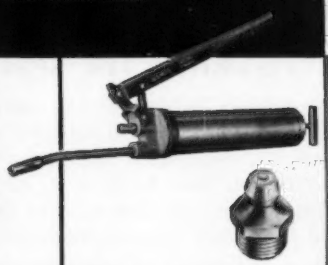
build powerful customer preference to help sell your farm implements!

ALEMITE

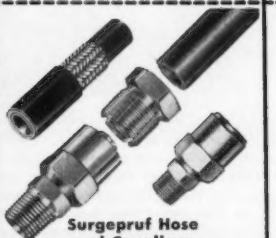
WORLD LEADER IN LUBRICATION EQUIPMENT

A complete line of proved equipment for every purpose... that farmers buy—and know best!

Big-A Bucket Pump
For light or heavy lubricants. Standard equipment on many leading makes of tractors and crawler equipment.



"RFD" Hand Gun and Red Ball Fittings
Big-volume, high-pressure delivery. Standard equipment on leading makes. Armorhard fittings for every purpose.



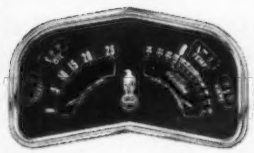
Surgepruf Hose and Couplings
Complete line of hose and components for every hydraulic use...medium-high and high-pressure service.

Accumite
Automatic centralized lubrication. No limit to number of bearings served. For corn pickers, combines, grain drills.

STEWART-WARNER

WORLD LEADER IN INSTRUMENTS AND GAUGES

All types, including complete drive equipment... designed, engineered and manufactured to your specifications!



Custom-built Panel
Complete instrument "packages" custom-built to your specifications.

Tractor Tachourmeter
Developed by Stewart-Warner especially for farm tractors.

Gauges
Only Stewart-Warner offers *all* types: Bi-metal, Magnetic, Diaphragm, Bourdon Tube.

Hardware
Includes all types of hood catches, fasteners and brackets, handles.

For further information, write

STEWART-WARNER

STEWART SW WARNER

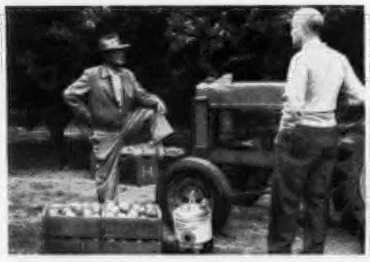
Dept. V-107, Original Equipment Sales • 1826 West Diversey Parkway, Chicago 14, Illinois

COMBINATION COULTER AND CULTIVATOR ADJUSTER runs ahead of cultivator. The wheel keeps plows from going too deep in wet soil. The coulter cuts vines ahead of plows to prevent tangling and piling up. Here is a real "two-problem" solver!

HE SOLVED TWO PROBLEMS IN ONE!

Corbitt Cobb (right) demonstrates his practical invention to Texaco Consignee Vance Hutchison. Plagued by vines fouling the plows while cultivating his peanut crop, he came up with the answer in this contraption. It works like a charm, too!

Consignee Hutchison supplies the 100-acre Cobb farm, near Enterprise, Ala., with Texaco products, including Marfak, the superior lubricant that cushions the bearings of tractors and field machinery. Marfak is best because it won't wash out, drip out, dry out or cake up. Mr. Cobb knows *it pays to farm with Texaco products.*



A 25-YEAR CUSTOMER! Texaco Consignee C. C. Fraser has been supplying Texaco products, including Advanced Custom-Made Havoline Motor Oil, to the Wissahickon Grove, Ocala, Fla., for 25 years. Consignee Fraser is shown here making a delivery of Havoline to Manager C. B. Morrison, for use in the farm's tractors, trucks, spraying machines and other field equipment.

IT'S FIRE CHIEF FOR HIM! John Orr, progressive farmer of Eaton, Ohio, uses Texaco Fire Chief gasoline exclusively on his 160-acre farm. He likes Fire Chief because of its lively fire-power, and low-cost operation of farm equipment. He also likes the dependable, neighborly service he gets from Texaco Consignee Hubert J. Miller and his driver P. C. Myers. Mr. Orr uses Texaco products exclusively.

DON'T WAIT until cold weather to order Texaco PT Anti-Freeze. One fill protects your tractor, truck and car all *winter*. PT Anti-Freeze won't boil away, doesn't foam, guards against rust and corrosion. Remember, PT is the top Premium Type anti-freeze. *Regardless* of price, its quality can't be matched. Be sure of your supply when you *need* it . . . play safe and order *now*.

ON FARM AND HIGHWAY IT PAYS TO USE

TEXACO Products

DIVISION OFFICES: ATLANTA, Georgia BOSTON 16, Massachusetts BUFFALO 9, New York BUTTE, Montana CHICAGO 4, Illinois DALLAS 2, Texas DENVER 3, Colorado HOUSTON 2, Texas INDIANAPOLIS 1, Indiana LOS ANGELES 15, California MINNEAPOLIS 3, Minnesota NEW ORLEANS 16, Louisiana NEW YORK 17, New York NORFOLK 2, Virginia SEATTLE 1, Washington

Texaco Products are also distributed in Canada, Latin America, and Africa.

TEXACO REG.T.M. THE TEXAS COMPANY

DU PONT
REG. U.S. PAT. OFF.
Better Things for Better Living
. . . through Chemistry

AGRICULTURAL MACHINERY NEWS
LATEST PROPERTY AND APPLICATION DATA ON
ZYTEL® nylon resin

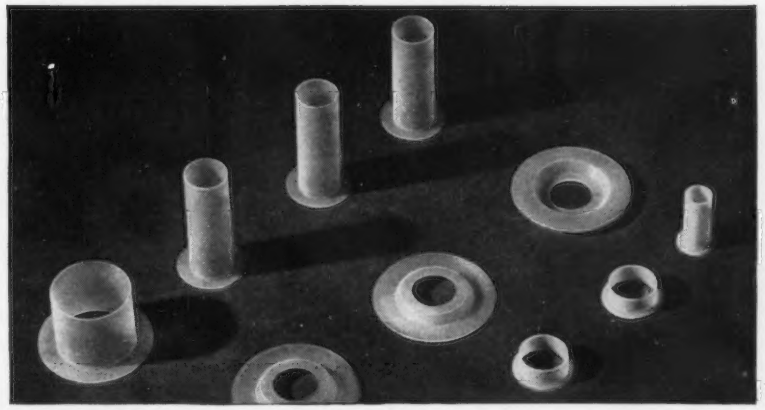
Bearings and bushings of ZYTEL® nylon resin are abrasion-resistant . . . need little or no lubrication

Tough, durable parts for agricultural machines made from Du Pont ZYTEL nylon resin stand up to rugged field work and often outperform metal parts they replace.

For instance, both gears and sleeve bearings of ZYTEL, tested in the presence of abrasive materials such as sand, outwear metal components by far. The load-carrying ability and temperature range of ZYTEL are approximately those of babbitt, with considerably better abrasion resistance.

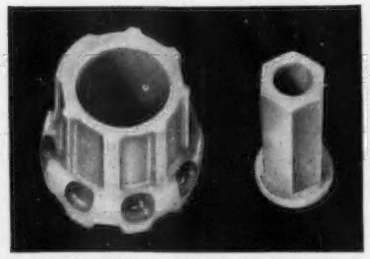
Under light loads, little or no lubrication is required for parts of ZYTEL. Operating with lubricant, simple sleeve bearings can support loads up to 1,000 lbs. per sq. in. at rubbing velocities up to 500 ft. per min. In one case, with only an initial lubrication, a bearing operated for 41 days without increase in temperature or torque.

Because of the resilience of the material, parts made of ZYTEL are quiet in operation, often damping or preventing the transmission of vibration to other components. Bearings of ZYTEL are resistant to pound-out. And components with thin walls, such as bushings, have high strength. Intricate shapes can be produced rapidly and economically to close dimensions by injection molding. And ZYTEL is rated for intermittent operation up to 250°F. For continuous operation at such elevated temperatures, heat-stabilized grades are available.

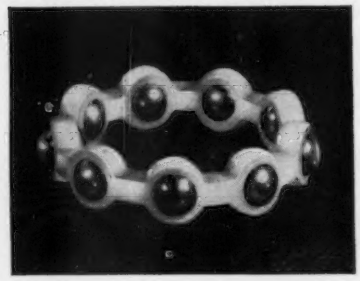


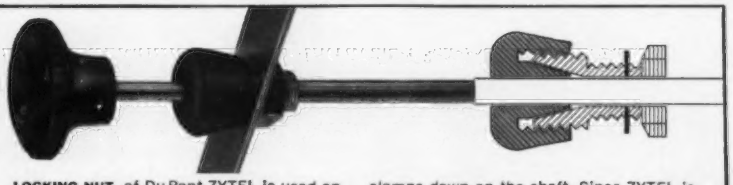
These brake-pedal bushings and window crank-handle bearing plates are made of ZYTEL. The parts give smooth, quiet operation and provide long-wearing bearing surfaces which, after assembly, do not have to be lubricated for the life of the vehicle.

Du Pont ZYTEL may be exactly the material you need to make hard-working machine parts. Send the coupon for free booklet. It contains scores of product ideas, showing how Du Pont ZYTEL has solved a variety of design problems.



Bearings of ZYTEL nylon resin shown above and ball retainer (below) feature excellent abrasion resistance, light weight, toughness in thin sections, heat resistance and resiliency.





LOCKING NUT of Du Pont ZYTEL is used on stationary engine to hold the throttle control in any given setting. The control knob may be moved freely in and out, but when it is given a quarter-turn, the nut (shown in red) turns with it, moves forward, and clamps down on the shaft. Since ZYTEL is tough and resilient, it springs back to original shape . . . has long life despite flexing. (Product shown above is manufactured by Western Control Corporation, Wichita, Kansas.)

SEND FOR INFORMATION

Mail this coupon for additional property and application data on Du Pont ZYTEL nylon resin.

E. I. du Pont de Nemours & Co. (Inc.) Polychemicals Dept.
Room 110, Du Pont Building, Wilmington 98, Delaware
Please send me more information on Du Pont ZYTEL nylon resin.
I am interested in evaluating this material for.

Name

Company Position

Street

City State

Type of Business

IN CANADA: Du Pont Company of Canada (1956) Limited, P. O. Box 660, Montreal, Quebec

For more facts circle No. 23 on reply card

What's he doing?

This is one of our field engineers, at work on a precision bearing installation for an experimental engine in a customer's plant.

He's one of the bearing experts from Cleveland Graphite Bronze, world's leading maker of sleeve-type bearings and bushings. Backing up on-the-spot field engineers like him is an advanced team of bearing design men, and a forward-thinking staff of scientists and technicians at the Clevite Research Center. After the engineering problems are solved, your orders are filled accurately and quickly by an up-to-the-minute, well distributed group of manufacturing units.

If you want this team working on your problems too, we'd be glad to hear from you.

CLEVITE
CORPORATION

Cleveland Graphite Bronze Co.
Division of Clevite Corporation
CLEVELAND 10, OHIO

CHICAGO DETROIT LOS ANGELES NEW YORK

BURLAP BULLETIN

News about packaging and agricultural and industrial developments in burlap

ANY OF THIS MATERIAL MAY BE REPRODUCED WITHOUT PERMISSION.

How to save a pile (of money)

Scenes on Mr. Jackson's farm: preparing empty burlap bags for return for cash; (1) Mr. Jackson pouring fertilizer into the spreader; (2) burlap feed bags get the heave-ho; (3) some of the empties are used on the combine.

Mr. Harlan Jackson, Montgomery, Alabama dairyman says, "Give me my feed and fertilizer in burlap bags. I've tried bulk delivery but prefer burlaps bags. I know exactly what I have on hand and there is no danger of mix-ups with formulas. Burlap bags make my work a lot easier and the money I get for returned bags really mounts up."

1 Buy feed and fertilizer in burlap bags that save handling time.

2 They don't tear and spill the contents when handled roughly.

3 Use the empties around the farm or sell them for cash.

These excerpts are taken from a recent study of farm supply delivery and handling methods. May we send you a copy?

THE BURLAP COUNCIL, 122 East 42nd Street, New York 17, N. Y.

THE BURLAP COUNCIL
122 East 42nd Street, New York 17, N.Y.

Please send a copy of the recent study of farm supply delivery and handling methods.

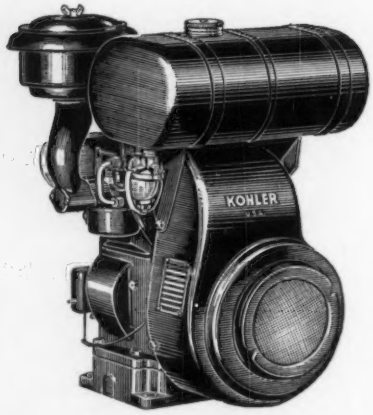
NAME_____

ADDRESS_____

For more facts circle No. 1 on reply card

KOHLER ENGINES

K90



K160

4-cycle · short stroke · air-cooled

—

On-the-job reliability

Kohler engines, in sizes 2 to 24 horsepower, conservatively rated, provide power for a wide range of applications. They are engineered for heavy duty, staunch service, and easy starting. Short-stroke design in each model and size insures smoothness and durability.

The Kohler name is your assurance of quality. Kohler engines power Kohler electric plants, known for reliability the world over for thirty-seven years.

Write for catalog with information about the Kohler engine and its many uses.

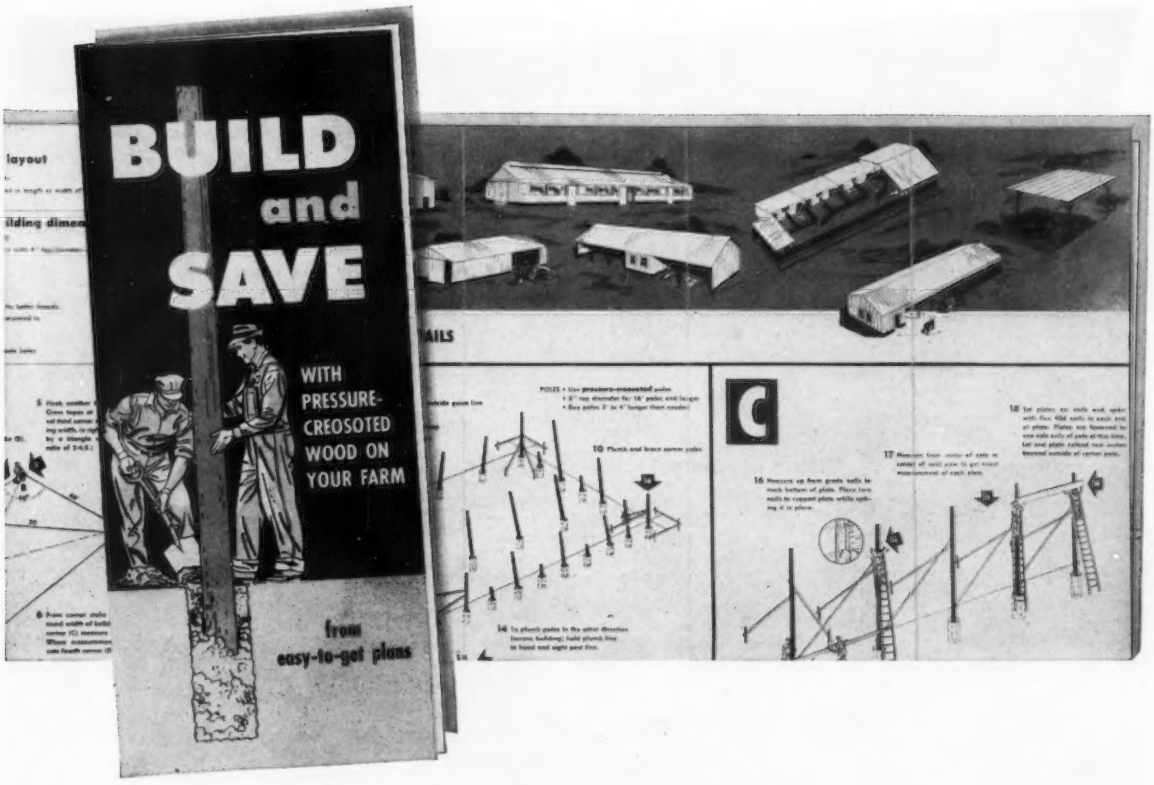
K330

K660

KOHLER CO. Established 1873 KOHLER, WIS.

KOHLER OF KOHLER

PLUMBING FIXTURES · HEATING EQUIPMENT · ELECTRIC PLANTS · AIR-COOLED ENGINES · PRECISION CONTROLS



Free Folder!

...on Pole-Type Construction

NO DOUBT many farmers are asking you questions about farm structures built with pressure-creosoted materials. To make it easier for you to answer these questions, United States Steel has prepared the illustrated folder shown here—a folder that explains the many advantages and economies to be gained by using pressure-creosoted poles, posts and lumber.

This folder contains drawings of pressure-creosoted farm and ranch structures such as range shelters, barns, poultry houses, and other units. It pays special attention to the popular pole-type method of construction. In fact, it shows step-by-step construction details of a typical pole-type building that can be erected by farm labor.

To get a supply of these free folders, just fill out and mail in the handy coupon. And remember, you can help farmers by relaying to them the information in these folders, or by giving them the folders.

UNITED STATES STEEL — USS CREOSOTE

Agricultural Extension, Room 2831
United States Steel
525 William Penn Place
Pittsburgh 30, Pennsylvania

Please send me..... folders titled "Build and Save"

Name .....

Address .....

County .....

City ..... State.....

UNITED STATES STEEL

A Browning GRIPBELT
FOR EVERY PURPOSE!
DOUBLE-V GRIPBELT
For multiple shaft drives. Driven shafts may operate in the same or opposite directions.
GRIPBELT, SUPER GRIPBELT
The high-quality all-purpose belts proved by years of satisfactory service in all types of drives.
GRIPLINK
This unique belt assembles to any length needed. Ideal where obstructions hinder belt replacement.
POLY-V* BELT
New multiple V-belt in single unit. Delivers more horsepower, cuts space requirements, eliminates matching problem.
* Raybestos-Manhattan, Inc.
FHP BELT
The perfect low-cost belt for all light-duty drives. Smooth, vibrationless power, longer life.
GRIPROLL
For special applications where endless belt cannot be used. Cuts to any length, splices readily.
STEEL CABLE GRIPBELT
Transmits heavier loads with smaller sheaves or fewer belts. Negligible stretch, longer life, greater economy.
Choose from these dependable Browning belts for every farm equipment need. With Browning's wide range of single and multiple groove sheaves, they form the most complete V-drive line available. Write today for details and your copy of illustrated catalog GC101.
Browning Manufacturing Company, Maysville, Kentucky.
Browning
POWER TRANSMISSION EQUIPMENT
V-DRIVES
PAPER PULLEYS
COUPLINGS
CHAIN DRIVES

MANUFACTURERS' LITERATURE

Flexible Shaft Couplings

Diamond Chain Co., Inc.—Bulletin No. 7 contains seven pages of illustrations and descriptions of the company's finished-bore and taper-lock flexible shaft couplings, and also revolving coupling casings for the finished-bore couplings.

(For more facts circle No. 64 on reply card)

Tube Working Tools

The Weatherhead Co. — An 8-page tool catalog 6111 features a new line of tube and hose working tools for flaring, burnishing, cutting, bending, reseating, tapping, presetting and counter boring. Instructions and specifications are included for each type of tool described.

(For more facts circle No. 65 on reply card)

Data on Air Conditioning Pumps and Circulators

Barnes Mfg. Co.—A pump selector chart designed to help commercial and domestic users of heating and cooling equipment choose the right model for their specific apaplications, is contained in a new catalog data sheet No. 345. The data sheet gives heads, capacities and other information on pumps and circulators used in air-conditioning, refrigeration and circulation applications.

(For more facts circle No. 66 on reply card)

Hydraulic Control Valve

Parker Appliance Co.—Descriptive details of the company's new hydraulic control valves for earth moving, material handling, agricultural and other mobile equipment are contained in catalog 1552A20-26. Each leaflet is illustrated and can be included in a three-ring notebook file.

(For more facts circle No. 67 on reply card)

Engine Hour Meter

John W. Hobbs Corp., Div. of Stewart-Warner Corp.—An 11-page bulletin describing the company's hour meter. Sections on general information, on aircraft hour meters, hour meters for alternating current, hour meter accessories, etc., are included. The bulletin is illustrated and has charts showing readings for different models.

(For more facts circle No. 68 on reply card)

Detergent-Inhibitor

Enjay Company Inc. — A 14-page illustrated technical report describing a new type detergent-inhibitor lubricant additive known as Paranox 302. It includes information covering typical analyses, field evaluations, taxi fleet tests, passenger car field tests, laboratory engine performance tests, sludging studies, ordnance qualification tests, etc.

(For more facts circle No. 69 on reply card)

Red Cedar Lumber Grades

West Coast Lumbermen's Assn. — A 36-page booklet that is illustrated and describes the range of Western red cedar uses and grades. The booklet is designed for the use of lumber sales personnel, architects, building officials and their representatives, and others concerned with lumber use. Replicas of grade stamps, conversion tables, recommended nailing practices, and roof decking spans are also included.

(For more facts circle No. 70 on reply card)

(Continued on page 760)

"This new Super 88 is more the farmer's tractor than ever!"

"Nobody had to sell me on the new Super 88. I'm an 88 man from way back—I like that four-bottom power. But I have to admit, with all those improvements, it's the farmer's tractor more than ever now. I mean things like the handy new three-point hitch... the new 12-volt ignition system... the new key starting. Why, there are more power 'helpers' here than you have in your car: power steering, 'Hydra-lectric' controls—even a new power shift to space your back wheels! Then, of course, you've got the comfort of Oliver's easy-riding seat, the convenience of the independent PTO. For fuel, you can take gasoline, diesel, LP-gas—whatever'll save you the most. You'll find I'm right when I say: Oliver gives me the power to produce at the lowest possible cost."

Buy your new tractor on the
"Pay as you Produce"
purchase plan
Ask your OLIVER Dealer

YOUR OLIVER DEALER ADDS: "It's not surprising they call Oliver the *farmer's tractor*. After all, the farmer is our biggest customer. It has never been any different—with Oliver, the farmer always comes first."

OLIVER
"FINEST IN FARM MACHINERY"

The Oliver Corporation, 400 West Madison St., Chicago 6, Illinois
Also Manufacturer of the Famous Oliver Outboard Motors

. . . Manufacturers' Literature

(Continued from page 758)

Spherical Bearings and Rod Ends

Sealmaster Bearing Div., Stephens-Adamson Mfg. Co. — Bulletin 257 lists features and engineering data on spherical bearings and rod ends.

(For more facts circle No. 71 on reply card)

Friction Facts

Caterpillar Tractor Co. — An 8-page illustrated booklet that answers questions about friction material in clutch facings and brake linings. Loss of friction, glazing and chipping, wear and torque capacity are discussed.

(For more facts circle No. 72 on reply card)

Enclosed Gear and Variable Speed Drives

Link-Belt Co. — A 4-page folder No. 2642 lists stock drive sizes and horsepower ratings of the company's new line of enclosed gear and variable speed drives. Selection charts are included which cover the line of stock drives of the following types: gearmotors, motorgears, worm gear drives, parallel shaft gear drives, in-line helical gear drives and PIV variable speed drives.

(For more facts circle No. 73 on reply card)

Electronic Relay

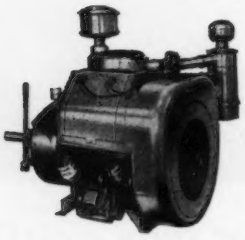
Arthur S. LaPine & Co.—This data sheet describes electronic relay designed especially for safe operation of laboratory water baths. It also lists components for constructing water baths.

(For more facts circle No. 74 on reply card)

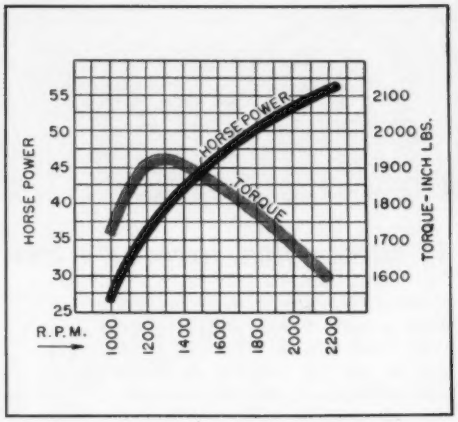
What makes *load-holding*

LUGGING POWER

in an engine?



Note the progressive, High Torque build-up as indicated on the power curve for the Model VR4D Wisconsin V-type, 4-cylinder, 56 hp. engine. Here's real load-holding Lugging Power!



Basic engineering makes the difference . . . in terms of HIGH TORQUE performance.

All Wisconsin Heavy-Duty Air-Cooled Engines are engineered and built with a HIGH TORQUE FACTOR. The resulting operating characteristics are such that the torque will *increase* under reduced engine speed. The tendency for the increasing load to slow down the engine is *resisted* with a strong "holding force" and the engine will "hang on" and make a quick power recovery under conditions that would stall most engines.

This load-holding Lugging Power is one of the important reasons why Wisconsin Engines are so well-suited to farm field service . . . service that calls for the *best* an engine can deliver. In addition, *all* Wisconsin Air-Cooled Engines are of heavy-duty design and construction in all details — including Stellite Exhaust Valves and Valve Seat Inserts . . . for long engine life and low-cost maintenance.

Dependable Air-Cooling at temperatures up to 140° F. give final assurance of "Most Hp. Hours" of rugged agricultural equipment service under your conditions.

You can't go wrong if you specify "Wisconsin Power" for your farm equipment. Write for Bulletin S-212.

WISCONSIN MOTOR CORPORATION

World's Largest Builders of Heavy-Duty Air-Cooled Engines

MILWAUKEE 46, WISCONSIN

A7-6124R

Auger Wagon

Knoedler Manufacturers, Inc. — This 4-page brochure illustrates the company's auger wagon in action, as well as in cutaway view. Features of the wagon are listed, including four available wheel arrangements. Use of optional center bulkhead for mixing is diagrammed. Specifications and dimensions are given for both 6-ft and 8-ft models.

(For more facts circle No. 75 on reply card)

Reference File for Plastics

Bakelite Company—A revised edition of the condensed reference file of Bakelite plastics, the 16-page booklet, No. 9515, is designed as a ready reference for designers, engineers and fabricators. It condenses a mass of technical information into easily understood terms. It is illustrated and includes charts which indicate the wide variety of plastics the company sells by major methods of fabrication.

(For more facts circle No. 76 on reply card)

Power Transmission Bulletin

Blood Brothers Machine Div., Rockwell Spring and Axle Co.—A condensed bulletin containing a general description of the company's line of universal joints, propeller shafts and drive line assemblies. A table showing the range of roller-bearing and sleeve bushing types available is included. Also capacity ratings are given and illustrations are used.

(For more facts circle No. 77 on reply card)

Plug-In Control Unit

Arthur S. LaPine & Co. — A data sheet describing a five-in-one plug-in control unit with circuit breaker instead of fuse.

(For more facts circle No. 78 on reply card)

Roll Lot V-Belting

Boston Woven Hose & Rubber Co., Div. of American Biltrite Rubber Co.—A descriptive sheet explaining the uses, advantages, and specifications for the company's line of Boston Bull Dog Roll Lot V-Belting. Equivalent length tables for V-belting replacements are included.

(For more facts circle No. 79 on reply card)

Lubricating Information

Marty's Maintenance Tools Div. — A 4-page use and application folder No. 571M of interest to the do-it-yourselfer, in the home, marine, farm or hobby shop. It gives preventive maintenance and use service information. The folder describes hand lube tools for outboards, power tools, farm, home and all shop equipment.

(For more facts circle No. 80 on reply card)

Broaches, Holders and Fixtures

Apex Broach Co., Inc.—A 4-page brochure showing some of the types and varieties of specialized equipment in the company's plant. It also describes the broach and tooling services available to customers to reduce production cost and increase efficiency through broaching.

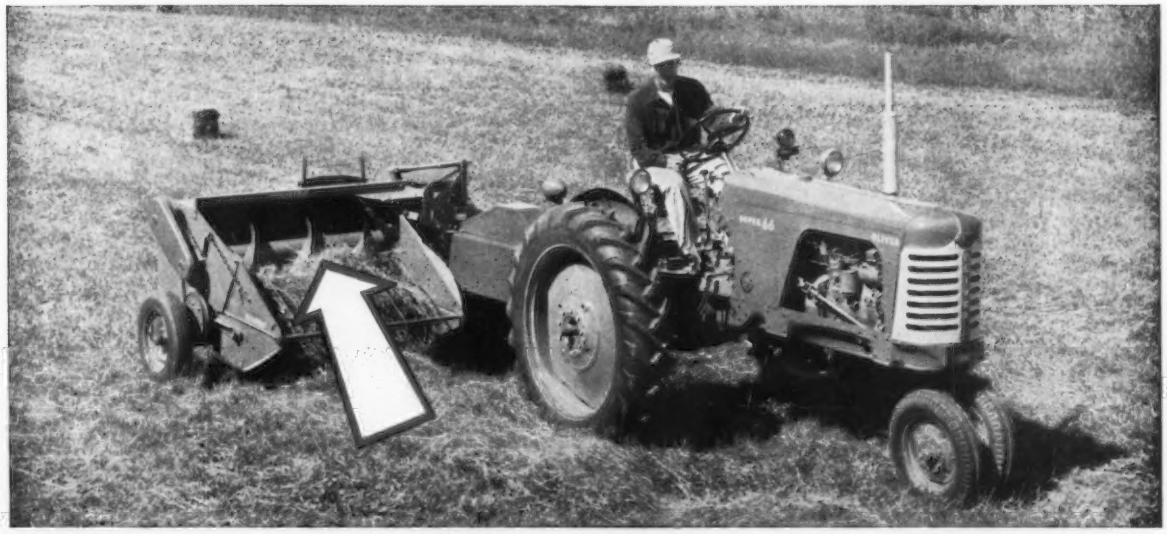
(For more facts circle No. 81 on reply card)

Mechanical Springs

American Spring & Wire Specialty Co.—This 24-page booklet contains a table of standard wire gauges; formulae for round wire springs compression and extension type and for square wire compression springs; Wahl's correction factor to determine corrected stress; specifications of extension and of compression springs; and charts of pitch diameter. Section on the spring design, and instructions for use of calculator and for the use of "deflation tables" are included.

(For more facts circle No. 82 on reply card)

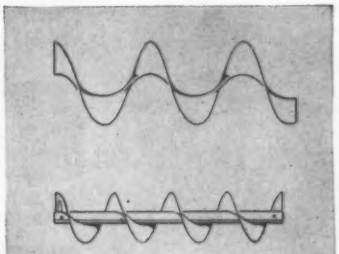
How LINK-BELT makes it easy to **work augers into your design**



THIS OLIVER HAY BALER incorporates one of many types of Link-Belt augers to compress and convey freshly cut hay to baling chamber.

WHERE augers are a vital part of any equipment, here's the sure way to better equipment design. Link-Belt augers are available in a full range of diameters, gauges and pitches . . . in any suitable metal to meet your most exacting requirements. And they're simple and compact, accurately made to insure dependable operation.

For any design problem involving augers ask the Link-Belt office near you for engineering assistance.



SELECTED FLIGHTING for all your auger needs. Helicoid, sectional or a range of other types are available in the metal and finish best suited for your design.

SIMPLICITY OF CONSTRUCTION and sturdy design of Link-Belt augers provide dependable, efficient operation on your machine. One basic assembly — no other moving parts to break down.

YOUR CHOICE OF METALS answers your requirements for handling corrosive or abrasive materials. And Link-Belt uses only specially selected steels.

ENGINEERING SERVICES. Our auger specialists will help to analyze your special needs . . . integrate all elements of your design for overall system efficiency.

ALL COMPONENTS — conveyor screws, collars, couplings, hangers, troughs, trough ends, flanges, drives—are available for every design.

LINK-BELT

FARM MACHINE AUGERS

Get in touch with the nearest Link-Belt office for your copy of Screw Conveyor Data Book 2289 . . . today.

14,599

LINK-BELT COMPANY: Executive Offices, Prudential Plaza, Chicago 1. To Serve Industry There Are Link-Belt Plants and Sales Offices in All Principal Cities. Export Office, New York 7; Canada, Scarboro (Toronto 13); Australia, Marrickville (Sydney), N.S.W.; South Africa, Springs. Representatives Throughout the World.

Elementary Soil and Water Engineering, by Glenn O. Schwab, Richard K. Frevert, Kenneth K. Barnes and Talcott W. Edminster. Cloth, 5½ x 8½ inches, viii+ 296 pages, illustrated and indexed. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York, N. Y. $6.25.

This book has been prepared for the reader with no previous training in engineering and presents up-to-date information gathered through experience and research. It emphasizes the engineering phases of soil and water conservation but also considers agronomic, economic, and other aspects of these problems.

Information on surveying and its application to farm design is included, plus material on the design and layout of conservation practices. Laboratory problems are presented in the appendix. Sample field notes are included to standardize and to illustrate the recording of field data.

Drainage of Agricultural Lands, Vol. 7 of Agronomy Monographs, edited by James N. Luthin, Irrigation Dept., University of California, Davis. Illustrated and 700 pages. Published by the American Society of Agronomy, 2702 Monroe St., Madison 5, Wis. $11.00.

This book is a comprehensive presentation of agricultural drainage problems from three viewpoints: those of the soil scientist, the engineer, and the plant scientist. The monograph is of interest to soils and drainage research workers, practicing engineers, soil conservationists, and agronomists. Seventeen authors from the United States and abroad have brought together the latest research on agricultural drainage.

The contents include topics on the physics of land drainage, theory of drainage, engineering aspects of land drainage, drainage investigation methods, and land drainage in relation to soils and crops.

Chemistry of Plants, by Erston V. Miller, research professor of botany, University of Pittsburgh. Cloth, 6 x 9 inches, indexed and illustrated, vii + 174 pages. Published by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. $4.75.

This book presents an up-to-date analysis of the chemical constituents of plants. Latest developments in plant chemistry are covered. Sections on plant hormones, vitamins, and the chemistry of photosynthesis are included. There is a chapter each on glycosides and alkaloids, and one chapter brings attention to the present frontiers of research in the chemistry of plants.

Also listed are chapters on carbohydrates, proteins and other nitrogen compounds, lipides, pigments, enzymes, organic acids, and minerals. The book should be of value to research workers in medicine, agriculture and food processing as well as organic chemists and specialists engaged in manufacturing agricultural chemicals such as fungicides, insecticides and phytocides.

Experimental Designs (second edition), by William G. Cochran and Gertrude M. Cox. Cloth, 6 x 9 inches, xiv + 617 pages, illustrated and indexed. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N.Y. $10.25.

This book could be considered a working manual for research workers and students in all branches of science. It is revised and expanded and presents a picture of useful experimental designs, with instructions for their use.

Two new chapters have been added. One chapter provides an account of the fractional replication of factorial experiments. Another chapter presents methods and designs for experiments in which the factors represent quantitative variables, measured on a continuous scale, and introduces experimental strategies for determining the optimum factor combination. Some sections have also been added and several describe the series of incomplete block designs developed during the past six years.

Polyethylene, by Theodore O. J. Kresser, technical service representative, Spencer Chemical Co., Kansas City, Mo. Cloth, 5 x 7½ inches, ix+217 pages. Illustrated and indexed. Published by Reinhold Publishing Corp., 430 Park Ave., New York 22, N. Y. $4.95.

This book gives a brief summary of the status of polyethylene applications at present, and a little history of the plastics industry, with special emphasis on the development and future of polyethylene.

It is claimed that this is the first book primarily concerned with the applications of polyethylene. Examples of the practical uses of the product are given and illustrated. The book shows what polyethylene has contributed to the building trades and agriculture. It could prove of use to the general, non-technical reader, the plastics technical man who has no knowledge of polyethylene, and the engineer or technical man in fields other than plastics who can utilize polyethylene for product improvement.

ROCKFORD
MORLIFE® Over-Center CLUTCHES
Provide

400% LONGER WORK LIFE

Small Spring Loaded

Heavy Duty Spring Loaded

Oil or Dry Multiple Disc

Heavy Duty Over Center

Power Take-Offs

Speed Reducers

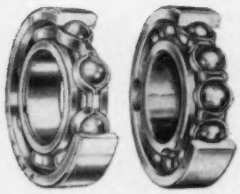
Reports from a wide range of users state that MORLIFE clutches serve from four to ten times longer than previous types of friction clutches using organic facing materials. Adjustments and plate replacements have been reduced to one-tenth those required by previous clutches. The longer on-the-job hours and increased pay loads which MORLIFE clutches make possible furnish a competitive advantage for machines in which these NEW clutches are used. Increased clutch life results in decreased operation cost of vehicles or equipment. Let our engineers show you how your product will benefit through using MORLIFE clutches.

SEND FOR THIS HANDY BULLETIN
Gives dimensions, capacity tables and complete specifications. Suggests typical applications.

ROCKFORD Clutch Division BORG-WARNER
1325 Eighteenth Ave., Rockford, Ill., U.S.A.
Export Sales Borg-Warner International — 36 So. Wabash, Chicago 3, Ill.

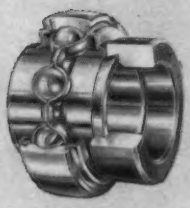
CLUTCHES

Radial Ball Bearings



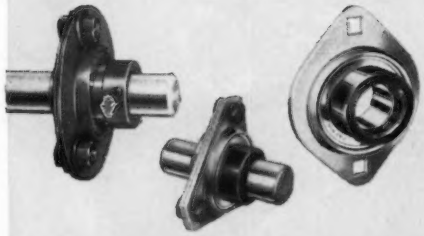
Any type, any size, for any purpose . . . available in extra light, light, medium sizes, in various tolerances, single and double row designs, duplex arrangements and with various types of seals and shields.

Wide Inner Ring Ball Bearings



The original . . . a Fafnir development. Available with either Mechani-Seals (slinger-type) or Piya-Seals (contact-type) plus the famous Fafnir-originated counterbored, eccentric cam, mated construction collar and inner ring. Easiest of all to install.

Pressed Steel Units



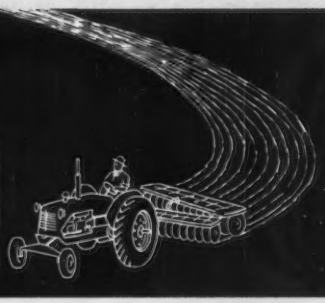
The Flangettes . . . leading, low-cost self-contained ball bearing units. Available with either Mechani-Seals (slinger-type) or Piya-Seals (contact-type) . . . also in three different shapes. All Flangettes are self-aligning at assembly.

PB Pillow Blocks . . . for light-duty applications. The unit consists of a two-piece separable steel housing with spherical bearing seat. Bearing is extended inner ring type with Piya-Seals (contact-type) and famous self-locking collar.

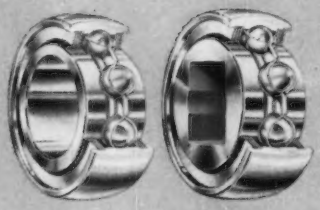
For every important turning point

FAFNIR BALL BEARINGS

and **POWER TRANSMISSION UNITS**



Tri-Ply Seal Bearings



Constructed with integral Tri-Ply-Seals, these Fafnir Ball Bearings designed for disc implements provide outstanding and proven protection against dirt and moisture. Pre-packed with long life lubricant which never needs to be replaced. Available with either round or square bores . . . self-aligning or rigid types.

Idler Pulley Units

Two types . . . one for V belts and one for flat belts or the back of V belts. Both types feature rolled outer edges, radial ball bearings with extra width inner ring construction and Piya-Seals. All idlers have 3 equally spaced weep holes to allow trapped water drainage when pulleys are mounted horizontally. Flat pulleys have a 5 degree outward taper on each side.

Cast Iron Power Transmission Units

For heavy duty, Fafnir cast iron ball bearing units provide the necessary strength and rigidity to withstand shock loads and vibration. All are equipped with the Fafnir Wide Inner Ring Ball Bearings with Self-Locking Collars. Available with either Mechani-Seals or Piya-Seals. For descriptive details on specific products, write The Fafnir Bearing Company, New Britain, Conn.

FAFNIR

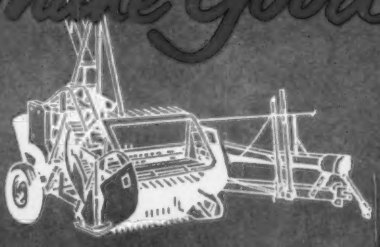
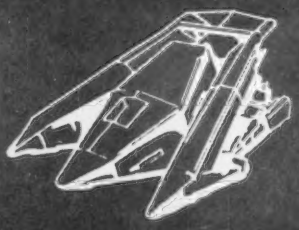
BALL BEARINGS

MOST COMPLETE LINE IN AMERICA

WARNER

GEAR BOXES

Make Good Products Better*

***FIELD CUTTERS, COMBINES, HAY BALERS, FORAGE HARVESTERS, CORN PICKERS**

Many a farm implement is no better than its gear box. That's why more and more leading manufacturers of rotary cutters, hay balers, combines, forage harvesters and other tools are standardizing on WARNER Gear boxes.

Every Warner Gear box is designed and engineered to transmit power efficiently and dependably, to withstand heavy shock loads. Built rugged, too—with automotive type gearing . . . carburized and hardened gears . . . anti-friction bearings throughout, individually selected for load . . . integrally forged gear and shaft . . . malleable iron housings when necessary.

What's more, Warner mass production techniques and facilities mean lower costs. So if you have a gear box problem, send it to Warner. No obligation, of course.

WARNER

AUTOMOTIVE PARTS DIVISION

ENGINEERING B-W PRODUCTION

Borg-Warner Corporation
Auburn • Indiana

Products of Experience

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Solve Your Gift Problems

Give something of lasting value, something to inspire and improve, something that will stand out as *YOUR* thoughtful remembrance. GIVE A SUBSCRIPTION TO AGRICULTURAL ENGINEERING to your farmer friends, to your favorite library, to executives interested in engineering or agriculture. Mail the card at the right to place your order. Subscriptions are $5.00 in the USA, $5.50 in Canada, $6.00 elsewhere. ASAE will send a letter to your honoree, in accordance with your instructions, giving details regarding his gift and the name of the donor.

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☐ I would like to send a GIFT subscription to AGRICULTURAL ENGINEERING to the person indicated below. I would like the subscription to begin with the _____ issue.

Please write the recipient for me advising that this is a Christmas_____, Birthday_____, other_____ gift. ($5.00 in USA; $5.50 in Canada; $6.00 elsewhere).

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☐ I am an ASAE member and suggest that membership, including application form be sent to the name and address below.

My name is _____

☐ I would like information about membership in the American Society of Agricultural Engineers including an application form.

Name _____

Position or title _____

Address (☐ **Home or** ☐ **Business**) _____

City _____ **Zone** _____ **State** _____

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2	12	22	32	42	52	62	72	82	92
3	13	23	33	43	53	63	73	83	93
4	14	24	34	44	54	64	74	84	94
5	15	25	35	45	55	65	75	85	95
6	16	26	36	46	56	66	76	86	96
7	17	27	37	47	57	67	77	87	97
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3	13	23	33	43	53	63	73	83	93
4	14	24	34	44	54	64	74	84	94
5	15	25	35	45	55	65	75	85	95
6	16	26	36	46	56	66	76	86	96
7	17	27	37	47	57	67	77	87	97
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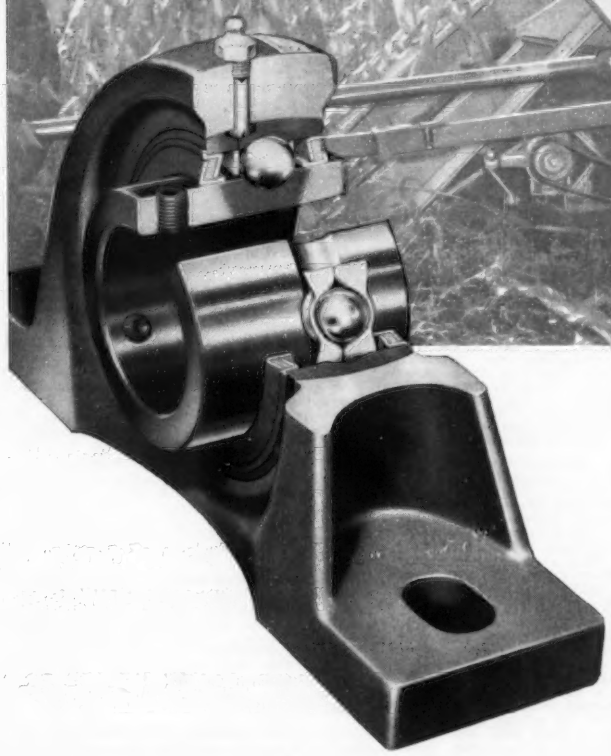
Our "Reader Information Service" clerks will see that your wants are promptly transmitted to sources of materials requested.

SEALMASTER'S

specified by McKee Brothers for outstanding field performance on their equipment!

Photo courtesy of McKee Brothers, Elmira, Ontario, Canada



The farmer's field is a real proving ground for bearing quality. Here, bearings must perform under stress of vibration, subject to dust, dirt and weather. SEALMASTER Ball Bearing Units are designed and engineered to meet these problems effectively. For example:

SEALMASTER engineers, well aware of the havoc played upon bearing performance by gritty dust and dirt, set about to solve the problem. The result, was a patented Labyrinth Seal, consisting of felt-lined steel flingers which rotate labyrinth, preventing entry of dust and dirt and retain proper lubrication for long bearing life.

This is but one of an exclusive combination of tested and proven SEALMASTER features important to the efficient operation of farm machinery under favorable or adverse conditions.

SEALMASTER®
BALL BEARING UNITS

Write for Bulletin 454 for full information

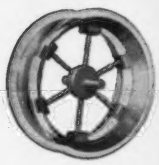
SEALMASTER BEARINGS A DIVISION OF STEPHENS-ADAMSON MFG CO. 67 RIDGEWAY AVENUE, AURORA, ILL.

For more facts circle No. 29 on reply card

ELECTRIC
Wheels · Axles · Spindles

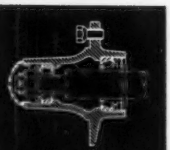
DIVIDED WHEELS
Generally used as dolly, tail or caster wheels

FOR TRUCK TIRES
Full drop center rim to utilize used truck tires on larger implements

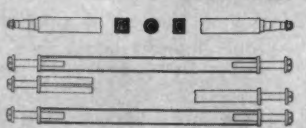


PLANTER WHEELS
Steel rim or for use with planter rubber tires

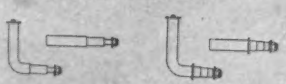
SIX BOLT SERIES
Light and heavy —widest range of implement use



Four bolt series for light implements



Hub and bearing combinations available. Stub spindles and full length axles.



Our Engineers Invite Your Inquiries

ELECTRIC WHEEL COMPANY
DIVISION OF THE FIRESTONE TIRE & RUBBER COMPANY
2806 SPRUCE · QUINCY, ILLINOIS

For more facts circle No. 31 on reply card

PERSONNEL SERVICE BULLETIN

NOTE: In this bulletin, the following listings current and previously reported are not repeated in detail; for further information see the issue of AGRICULTURAL ENGINEERING indicated. "Agricultural Engineer" as used in these listings is not intended to imply any specific level of proficiency or registration as a professional engineer. Items published herein are summaries of mimeographed listings carried in the Personnel Service, copies of which will be furnished on request. To be listed in this Bulletin, request form for Personnel Service listings.

POSITIONS OPEN — APRIL — O-90-718. MAY —O-154-721, 154-722, 155-723, 165-725. JUNE— 189-729, 170-730. AUGUST—O-183-734, 196-735, 248-736, 255-737, 259-738, 265-739. SEPTEMBER — O-267-741, 267-742, 267-743, 267-744, 281-745, 292-746, 264-747, 264-748.

POSITIONS WANTED — APRIL—W-68-5, 74-6. MAY—W-51-7, 96-8, 128-9. JUNE—W-186-11, 171-12, 180-13, 190-14. JULY—W-193-15, 192-16, 238-17. AUGUST — W-206-18, 247,20, 254-22, 239-23, 256-25, 261-26. SEPTEMBER—W-278-27, 276-28, 262-29, 288-30, 296-31, 286-32, 299-33, 290-34.

NEW POSITIONS OPEN

AGRICULTURAL ENGINEERS (3) for sales work in export field with large American manufacturer of farm and industrial tractors and related equipment. Fifteen months training period at company headquarters in Midwest, followed by foreign assignment. Age, under 34. College degree. Good mechanical background plus experience and preference for work with heavy equipment. Pleasing personality, initiative, good appearance and other leadership qualities. Opportunity for advancement to a sales management position. Training period salary up to $550 per month, subsequent salary dependent on individual ability. O-272-749.

AGRICULTURAL ENGINEER (assistant professor) for research and extension in machinery and materials handling equipment field with land grant university in an eastern state. MSAE. Farm background. Some experience in research or extension. Major interest in machinery and farmstead equipment. Excellent facilities and opportunities for research. Extension setup permits individual to develop program in his specific field. Salary $6,210-6,450, depending on experience. O-334-750.

AGRICULTURAL ENGINEER (assistant professor) for extension 4-H specialist with land grant university in an eastern state. MSAE or MS in agricultural education with strong background of undergraduate work in agricultural engineering. Experience in 4-H extension or vocational agriculture teaching. Strong interest in youth programs. Position available by December 16. Salary $5,748-6,696. O-334-751.

AGRICULTURAL ENGINEER (assistant or associate professor) for research (¾ time) and teaching (¼ time) in power and machinery or processing field, with land grant university in an eastern state. Age, under 45. MSAE, or equivalent. Prefer several years experience in an agricultural engineering department or in commercial work. Will consider outstanding recent graduate. Must be able to work with others. Excellent opportunity for advancement. Salary open. O-339-752.

AGRICULTURAL ENGINEER (associate professor or professor) for research (¾ time) and teaching (¼ time) in rural electrification in an eastern land grant university. Age, under 50. MSAE, or equivalent. Must have held a responsible position on an agricultural engineering staff. Some commercial experience desirable. Should have initiative, be willing to take responsibility, be able to work with other staff members and to direct graduate students. Good opportunity to show leadership in development of strong program. Salary open. O-339-753.

FARMER to manage and operate 320-acre, 600-gallon bulk dairy farm. A BSAE or degree in agriculture is required, along with on-the-farm experience of not less than five years. The candidate should understand and like dairying, and have an understanding of animals in addition to know-how in materials handling and sound management procedure. The operation is designed for volume production at maximum efficiency, and a competent operator can expect to realize a substantial income. Reply in detail, describing accomplishments and experience. O-336-754.

TERRITORY REPRESENTATIVES (2) for dealer sales of specialized farm and light industrial equipment in Midwestern state; with established wholesale distributor. Age 25-45. College education, BSAE preferred. Farm background and sales experience. Good personal habits. Self-starting and willing to work. Excellent opportunity to develop territory and advance into management, depending on performance. Salary guarantee during orientation period, then straight comission. O-314-755.

NEW POSITIONS WANTED

AGRICULTURAL ENGINEER for extension, teaching, research and writing technical research reports in power and machinery field with college or experiment station in Southwest. Prefer college location with opportunity to work toward PhD. Married. Age 26. BSAE, 1953; MSAE, 1957; both from Louisiana State University. Construction engineer, 3 months with cement company. Chief inspector, Ammonia Commission of Louisiana, 12 months. Research assistant and graduate student, Louisiana State University, 30 months. Commissioned service 18 months, USAF. Approximately 60 days notice. Salary $6,600. W-289-35.

AGRICULTURAL ENGINEER for sales or management, in power and machinery field with manufacturer. Any location in USA. Married. Age 34. No disability. BSAE, 1951, University of Maine. Sales representative with farm equipment manufacturer since 1951. War enlisted service in US Navy. Available on reasonable notice. Salary $10,000. W-326-36.

AGRICULTURAL ENGINEER for design, development, or sales in power and machinery or farm structures field with manufacturer. Anywhere in USA. Married. Age 40. No disability. BSAE, 1940, Iowa State College. Farm background. Drafting and design on farm equipment one year; aircraft, 3 years. Farming one year. Agricultural sales engineer with manufacturer of power transmission chain, 6 years. Advanced study 5 years. Teaching engineering drawing in high school, one year. War enlisted service as electronic technician in US Navy, 18 months. Available on reasonable notice. Salary $7,500. W-335-37.

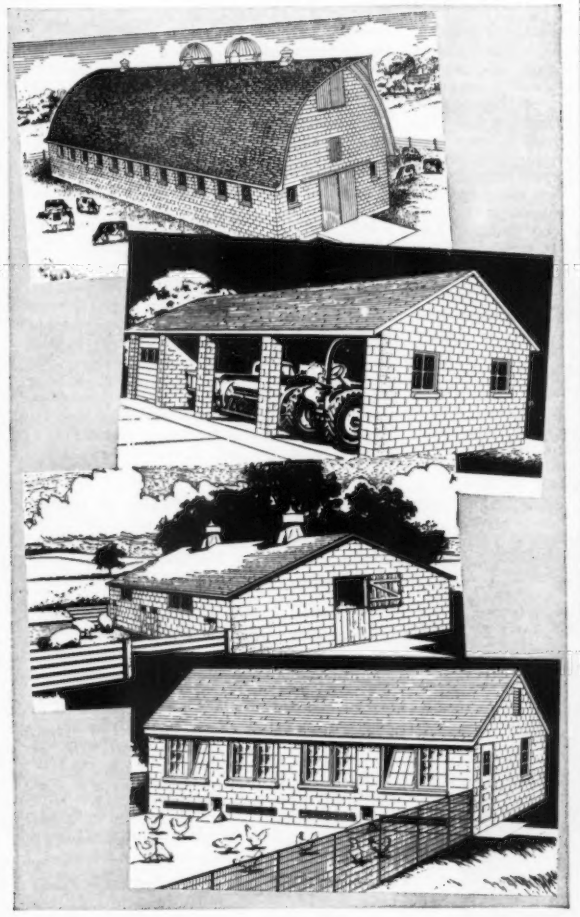
AGRICULTURAL ENGINEER for sales or management with industry in power and machinery or rural electric field. Location in USA or foreign. Willing to travel. Married. Age 34. No disability. MS degree, Michigan State University. Teaching experience 2 years. Field and sales experience, 7 years in US and Central and South America, with large manufacturer, including 3 years in office and management. War service in European Theatre. Available on two weeks notice. Salary open. W-331-38.

NEW GRADUATE for design, development, or sales in farm structures or soil and water field with consultant, farming operation, or trade association in South or Southwest or Central or South America. Married. Age 28. No disability. BS in agriculture expected in January 1958, Texas Technological College. Farm background. Summer work with ASC, SCS and with farm contractor. Student assistant in agricultural engineering department. Navy enlisted service, 4 years. Available February 1958. Salary $4800-5,000. W-340-39.

NEW GRADUATE AGRICULTURAL ENGINEER for development or research in power and machinery or soil and water field with public service. Location, East or West Coast, Africa or South America. Single. Age 22. No disability. BSAE expected June 1958, Cornell University. Three summers on dairy, fruit and vegetable farms; one with farm equipment manufacturer. Available July 1958. Salary $4,000. W-341-40.

SALES AND SERVICE MAN for work in these fields or related writing and management in farm structures, rural electric or product processing with manufacturer, distributor or trade association, anywhere in USA. Other locations considered. Willing to travel. Married. Age 27. No disability. High school major in science and mathematics. Licensed pilot. Experience 6 years in farm operation and management; 4 years engineering and contracting on dairy systems, livestock feeding and handling systems, pole frame buildings, irrigation and crop drying. Available January 1958. Salary open. W-301-41.

AGRICULTURAL ENGINEER for advanced design, development, research, sales, service, writing or management in power and machinery field with special emphasis on materials handling equipment and equipment systems with manufacturer, or consultant, preferably in Midwest. Married. Age 47. No disability. Mechanical engineering training. Experience 15 years including design, engineering research, writing, commercial and technical art, advertising and sales, with advancement to chief engineer. War Commissioned service in Field Artillery and Air Force, 4 years. Available on reasonable notice. Salary open. W-297-42.



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You can recommend concrete masonry barns, machine sheds, hog and poultry houses and other buildings for economy. They are moderate in first cost, require little upkeep and give long years of service. That's ***low annual cost.***

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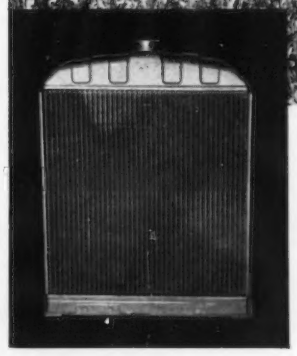

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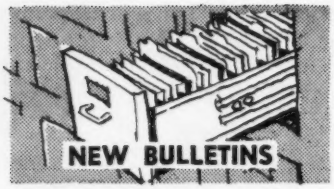

Suggestions for Cotton Irrigation in Louisiana, by Kenneth A. Koch, assistant agricultural engineer, and I. W. Carson, associate agronomist in cotton, Louisiana State University. Agricultural extension publication 1207, March, 1957.

The purpose of this bulletin is to set forth basic information on cotton irrigation. It includes sections on varieties of cotton, land preparation, time of planting, growth habits of cotton, principles of irrigation, how much water to use, helpful signs, a "feel" chart for available soil moisture, when to irrigate, shedding of bolls and squares, fertilization, and weeds, diseases and insect control.

Buckeye Farm Drainage News, a new publication, is now available to farmers, soil conservation officials and drainage contractors. It is edited by Willard Cutler, ASAE member and drainage engineer of Michigan State University, and is published regularly in the interest of better farm drainage by Gar Wood Industries, Inc. The publication is in the form of a newsletter, and contains up-to-the-minute information on new farm drainage practices, effects of farm drainage on crop yields and other data of interest to both the farmer and drainage expert in every part of the country. Free subscriptions may be obtained by writing to Buckeye Farm Drainage News, Gar Wood Industries, Inc., Wayne, Mich.

Planning a Machinery Storage Layout, by G. E. Henderson and C. E. Turner, Southern Association of Agricultural Engineering and Vocational Agriculture. For copies write Coordinator's Office, SAAE & VA, Barrow Hall, Athens, Ga. 60 cents.

This publication presents the most up-to-date information on protection of farm machinery by different methods. It also describes the best procedures to follow in planning a machinery storage that will fit the user's needs.

The contents include: whether to build a machinery storage, the type of machinery storage to build, location, determining the space requirements for equipment and building size, location of entrances, the installation of electrical outlets and switches, the number of branch circuits to use, and the size service-entrance equipment to use.

Nebraska Minimum Standards for Artificially Gravel Packed Irrigation Wells, by P. E. Fischbach, P. E. Schleusener and V. H. Dreeszen. Approved by Nebraska Well Drillers Association. Bulletin E. C. 57-702, August, 1957.

The purpose of this 18-page bulletin is to facilitate an understanding or agreement between the purchaser of an irrigation well and the well driller so that the best possible well may be obtained under existing natural conditions. The publication includes sections on specifications, test drilling, drilling the well, casings, gravel pack, well development, well testing and completion test. It explains how a properly constructed irrigation well can last at least twenty years under normal conditions.

Irrigation of Field Beans in Idaho, Research Bulletin No. 37, May, 1957, by Victor I. Myers, G. L. Corey, Marshall LeBaron, and Galen McMaster. Agricultural Experiment Station, University of Idaho, Moscow.

Dry beans are well adapted for production in Idaho, but because of the dry climate, it is necessary to use irrigation to supply moisture for plant growth. The irrigation experiments conducted on the Twin Falls Branch Experiment Station and reported in this bulletin show several critical aspects of irrigation as applied to the production of dry beans. It discusses factors to be considered in deciding when to irrigate and how much water to apply, such as the kind of soil, weather conditions, depth of plant roots, and other variables which influence the irrigation cycle.

Equipment and Layout for Fruit Packing Houses, by H. P. Gaston and J. H. Levin, Agricultural Experiment Station, Michigan State University, East Lansing. Special Bulletin 417, July, 1957.

The introduction of fork-lift trucks has brought about changes in fruit-handling methods. These changes have a direct bearing on fruit packing house design and this publication is a report of a study made by AERD, USDA, and the Michigan Agricultural Experiment Station. It replaces Special Bulletin 362, Fruit Packing Houses, Plans and Operations.

The contents cover discussions on when and how the study was conducted, advantages of on-the-farm packing facilities, cost of building and equipment, location, packing house design, types of equipment, and packing operation.

Fertilizing For Higher Yields, issued by Deere and Company, Moline, Ill.

This booklet contains a collection of articles recently published in "The Furrow." The first seven describe profitable fertilization practices used in various parts of the United States and Canada. The remaining articles discuss the use of liquid fertilizers, manure, lime, and the importance of proper placement. It includes sections on increase your fertilizer rates, fertilizing cotton for bigger profits, fertilizing corn for bigger profits, fertilizing crops for bigger profits, fertilizing wheat for bigger profits, fertilizing for low-cost feeds, fertilizer offsets decreasing yields, liquid fertilizer, the value of manure, need for lime, and proper placement.

The chief purpose of these articles is to point out several ways, proved by experience, for obtaining maximum returns from your fertilizer investment.

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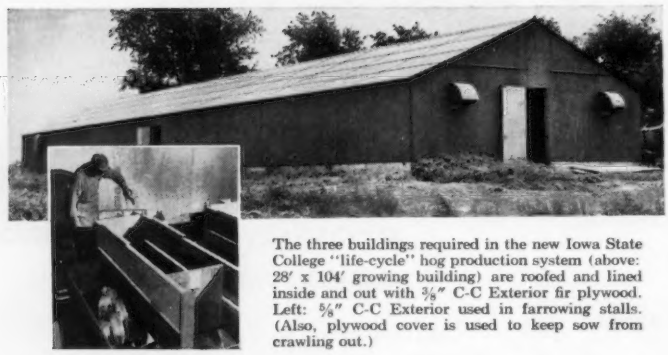

The three buildings required in the new Iowa State College "life-cycle" hog production system (above: 28′ x 104′ growing building) are roofed and lined inside and out with ⅜" C-C Exterior fir plywood. Left: ⅝" C-C Exterior used in farrowing stalls. (Also, plywood cover is used to keep sow from crawling out.)

"Fir plywood saved labor, made buildings less costly," says Max Bailey. "Big panels reduce joints, cut heat loss and drafts, and make cleaning easier."

HERE's proof of fir plywood's advantages. Max Bailey, Story County, Iowa, selected C-C Exterior fir plywood to construct all three buildings required in the new Iowa State College "life-cycle" hog production system. Exterior fir plywood cuts costs, permits tighter construction, reduces maintenance. See your lumber dealer for C-C Exterior fir plywood–the economical panel with 100% waterproof marine-type glue, for permanent exposure to weather or water. *Be sure it's marked C-C EXTERIOR.*

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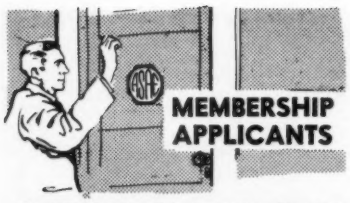

The following is a list of recent applicants for membership in the American Society of Agricultural Engineers. Members of the Society are urged to send information relative to applicants for consideration of the Council prior to election.

Baker, Charles L.—Asst. chief engr., Massey-Harris-Ferguson, Inc., 12601 Southfield Rd., Detroit 23, Mich.

Bethlendy, George — Test engr., International Harvester Co. of Canada (Mail) 63 Chedoke Ave., Hamilton, Ont., Canada

Billett, John — On duty U.S. Army (Mail) Hamilton, Mich.

Driggers, Louis B.—Asst. ext. agr. engr., agr. eng. dept., Virginia Polytechnic Institute, Blacksburg, Va.

Gallego, Manuel Jr. — Exec. vice-pres., Gallego Institute of Agriculture and Industry, 43 Broadway, Quezon City, Philippine, Is.

Hayes, Arnold A.—Irrigation engr. and sales supervisor, Olin Mathieson Chemical Corp., 800 South 72nd, Omaha, Nebr.

Holland, Arthur B.—Agr. engr., SCS, USDA, 433 Wilson, Morgantown, W. Va.

Johnson, Richard L. — Mechanical engr., Ordnance Management Eng. Training Center, Bldg. 90, Rock Island Arsenal, Ill.

Lagomasino, Jorge C. — Agr. engr. spec., Zona Norte, Proyecto 39, TCP, OAS, Interamerican Institute of Agricultural Science, Apartado 2861, La Habana, Cuba

McMillen, Bobby E.—Assoc. engr., Chance Vought Aircraft, Inc., Dallas, Tex. (Mail) R.R. 4, Ponfotos, Miss.

Moden, Walter L. Jr.—Res. engr., agr. eng. dept., University of Idaho, Moscow, Ida.

Montenegro, Jose A. P.—Dir., Associado de la CIA, Estacion Experimental Agronomica, Santiago de las Vegas, Habana, Cuba

Nelson, Glenn S.—Instr., agr. eng. dept., University of Arkansas, Fayetteville, Ark.

Ramsay, Richard A.—Sales mgr., Mechanics Universal Joint Div., Borg-Warner Corp., 2020 Harrison Ave., Rockford, Ill.

Walters, Dale E.—Graduate student, West Virginia University (Mail) Box 144, R.R. 1, Weirton, W. Va.

Zolfaghari, Mozafareddin—Student, North Carolina State College (Mail) P.O. Box 5513, College Station, N. C.

Transfer of Grade

Hart, Samuel A.—Asst. agr. engr. and asst. prof., agr. eng. dept., University of California, Davis, Calif. (Associate Member to Member)

Palmer, Robert S.—Proj. supervisor and agr. engr. (SWCRD, ARS) USDA, agr. eng. dept., University of New Hampshire, 109 Pettee Hall, Durham, N. H. (Associate Member to Member)

Trapp, Richard O. — Quality control engr., Ford Motor Co., Tractor and Implement Division (Mail) 134 Ferndale, Rochester, Mich. (Associate Member to Member)

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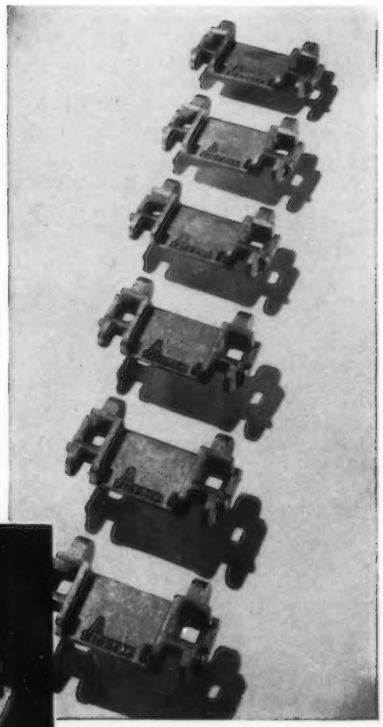

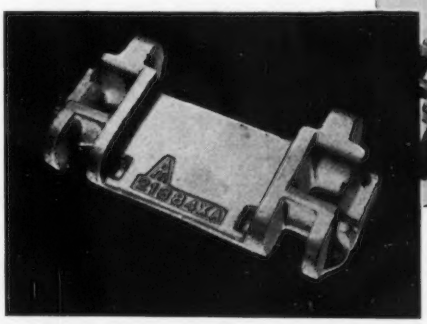

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RESEARCH NOTES

Brief news notes and reports on research activities of special agricultural-engineering interest are invited for publication under this heading. These may include announcements of new projects, concise progress reports giving new and timely data, etc. Address: Editor, AGRICULTURAL ENGINEERING, St. Joseph, Michigan.

Decorticator for Istle Fiber

A mobile machine for decorticating the coarse fiber of the *Agave lecheguilla* plant, native of certain areas in Texas, New Mexico, and Mexico, has been designed by Mills Byrom of the Long Fiber Plants Section of the AERD. The decorticator, a modified version of machines used for coarse fibers produced from other plants, is the first step toward mechanization to make possible fiber production from lecheguilla plants harvested in the United States from the wild. The supply of fiber available, especially in the past few years, has been far below demand as laborers in Mexico have turned to more profitable pursuits.

Discovery recently that the lecheguilla plant also yields a substance that is a source of cortisone, used in treatment of arthritis, and certain other drugs, add to the possibilities for production of the plant as a cultivated crop in the United States. No move has been made in this direction, however, except for a small experimental planting at Belle Glade, Fla., where Byrom is stationed and has carried on his experiments with the decorticator.

Fiber from the Agava lecheguilla plant is one of the most acceptable of coarse fibers for brushes used in scrubbing and for many other purposes. Samples of the fiber as decorticated by Byrom's machine, appeared acceptable for commercial use, according to officials of one of the nation's larger fiber processors. This one firm, capable of using about a carload per week of the istle fiber, now rarely receives more than four carloads a year.

O. A. Brown Named USDA Consultant

Dr. O. A. Brown, recently retired as a staff member of the Farm Electrification Labortary of the AERD, has been retained by USDA as a consultant on continuing cooperative research at the Tennessee Agricultural Experiment Station in connection with the use of an electrical device for the shock treatment of seed. He will also advise on other research activities in farm electrification.

Until recently a member of ASAE, Mr. Brown, who is also a World War I overseas veteran, will operate his farm in West Virginia. He has been with AERD since 1939.

Towards Increased Efficiency on Dairy Farms

The Farm Electrification Laboratory and Livestock Engineering and Farm Structures Branch of AERD have combined forces on time and motion studies for possible application of electrical energy, building arrangements and designs to reduce hand labor and increase efficiency on dairy farms.

Handling the electrical phases of the study are J. G. Hartsock, Minnesota Agricultural Experiment Station, St. Paul, who was formerly at Beltsville; L. E. Campbell, Agricultural Research Center, Beltsville; and Dan Vilander, Washington Agricultural Experiment Station, Puyallup. Vilander has just returned from military service.

Farm buildings engineers assigned to the project are Thayer Cleaver, California Agricultural Experiment Station, Davis, who was formerly at Urbana, Ill.; Russell E. Larson, Minnesota Agricultural Experiment Station, St. Paul, who was stationed at Columbia, Mo.; and Harry Eby, Maryland Agricultural Experiment Station, College Park. Eby was transferred from USDA in Washington, D. C.

Psychroenergetic Tests

Psychroenergetic tests of beef and dairy cattle are giving USDA scientists valuable information for designing shelters of optimum temperature for farm animals. These tests, conducted by engineers of Agricultural Engineering Research Division and the Missouri Agricultural Experiment Station, Columbia, Mo., are helping to determine the ability of animals to use feed efficiently under controlled conditions of temperature and humidity.

Three breeds of calves—Shorthorn, Brahman, and Santa Gertrudis (a cross of the preceding two)—were used in the experiment to measure the effect of 50 and 80-deg F temperatures on growth, production, health, and feed consumption of the animals from 1 to 16 months.

Results of such tests show that Santa Gertrudis calves made normal weight gains when reared at room temperatures of 50 and 80 deg, and in the open shed. On the other hand, Shorthorns were handicapped at the 80-deg temperature, while the Brahmans made their best gains at that level. Gains of Shorthorn and Brahman calves in the outside pens were normal for both of these breeds.

Similar tests for three dairy breeds—Holstein, Jersey, and Brown Swiss—are also underway.

. . . Events Calendar

(Continued from page 744)

November 13-15 — *Eighth National Conference on Standards, American Standards Association, Inc.,* Saint Francis Hotel. San Francisco, Calif. The theme is Standards — Key to Progress and Profits.

November 14-15 — *Irrigation Conference,* Lubbock Hotel, Lubbock, Texas.

November 13-27 — *The Building Exhibition* at Olympia, London, England. It covers current development in more than fifty industries connected with building.

November — *International Symposium on Saline Water Conversion,* Washington, D.C., under the sponsorship of the Office of Saline Water of the U.S. Department of the Interior, and the National Academy of Sciences — National Research Council. Inquiries should be addressed to the Division of Physical Sciences, National Academy of Sciences, 2101 Constitution Ave., N.W., Washington 25, D.C.

December 9-12—The 23rd annual convention of the *National Junior Vegetable Growers Association,* Hotel Abraham Lincoln, Springfield, Ill.

December 26-31 — Annual meeting of the *American Association for the Advancement of Science* will be held in Indianapolis, Ind. More information will be available at a future date.

March 16-21—*1958 Nuclear Congress* will be held at the Chicago Amphitheatre, Chicago, Ill. It is managed by the American Institute of Chemical Engineers and coordinated by the Engineers Joint Council and will include the 4th Nuclear Engineering and Science Conference, 4th International Atomic Exposition, 6th Atomic Energy in Industry Conference, 6th Hot Laboratories and Equipment Conference, and the American Power Conference. For further information write to Engineers Joint Council, 29 W. 39th St., New York 18, N. Y.

April 11-18 — *Fifteenth International Horticultural Congress,* Nice, France, on the Cote d'Azur. The theme will be on science in the service of horticultural techniques.

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Burlap Council 755
Caterpillar Tractor Co. 702
Cleveland Graphite Bronze Co. 754
Crucible Steel Co. of America 699
Dayton Rubber Company 704, 705
Deere & Company 710, 711
Douglas Fir Plywood Association 770
E. I. du Pont de Nemours & Co. 753
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The Enjay Company 717
Fafnir Bearing Co. 763
Hyatt Bearings Div., General Motors Corp. 706
International Nickel Co., Inc. 716
Kohler Company 756
Link-Belt Company 703, 761
National Seal Div., Federal-Mogul-Bower Bearings, Inc. 701
New Departure, Div. of General Motors 3rd cover
The Oliver Corporation 759
The Perfect Circle Corp. 720
Pittsburgh Forgings Co. 772
Portland Cement Association 769
Purolator Products, Inc. 713
Rockford Clutch Div., Borg-Warner Corp. 762
Rollway Bearing Co. 714
Russell, Burdsall & Ward Bolt and Nut Co. 719
Standard Stamping & Perforating Co. 774
Stephens-Adamson Mfg. Co. 767
Stewart-Warner Corp. 751
The Texas Company 752
Timken Roller Bearing Co. 4th cover
The Torrington Co. 709
Unitcast Corporation 771
U. S. Steel Corp. 757
Veeder-Root, Inc. 718
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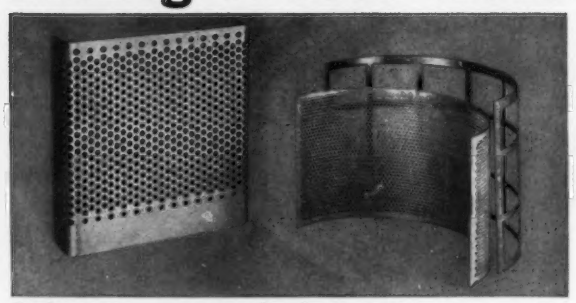

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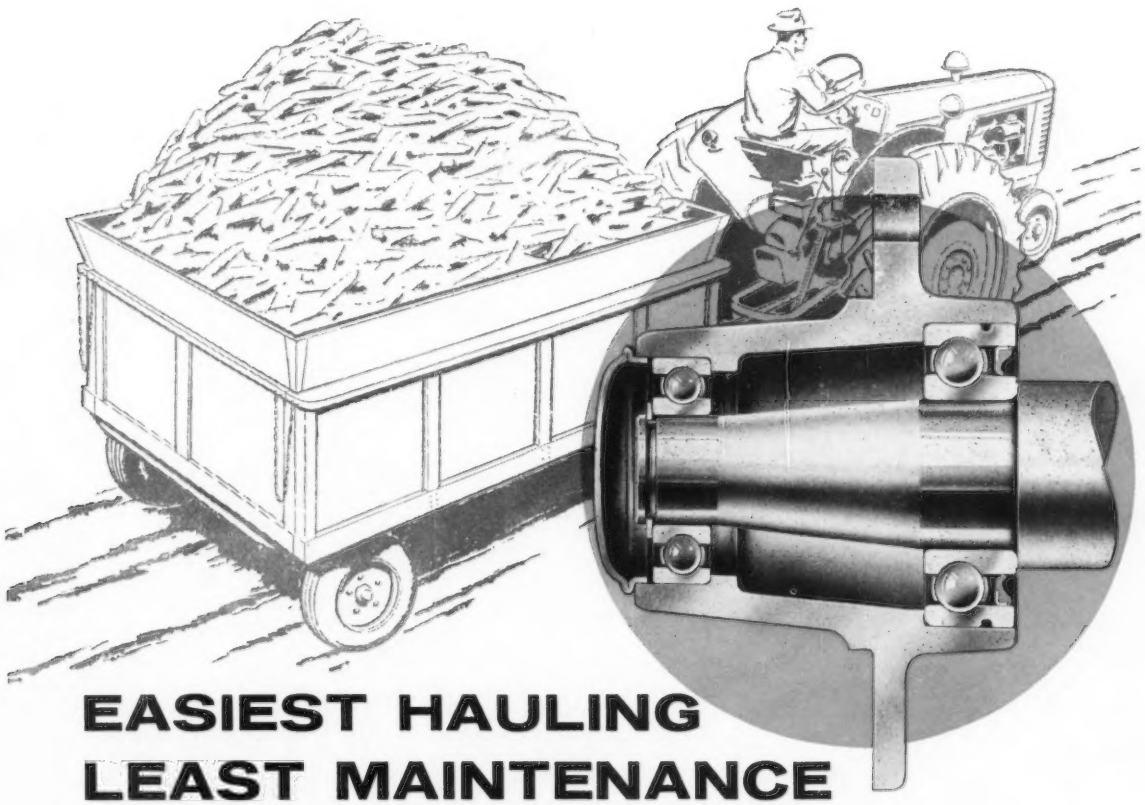

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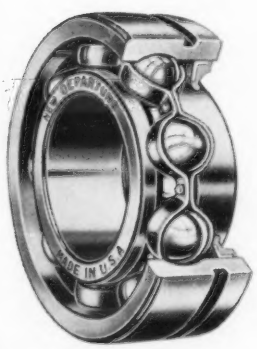


In this wheel bearing the seal is contained inside the bearing and makes perfect contact with the smooth-finished inner ring.

Heavy wagon or implement wheels on these New Departure ball bearings not only give the farmer the *easiest*, freest-rolling mounting—they require *no adjustments, no periodic greasing*. The farmer need never give them a thought!

And the mount is a honey for simplicity—no adjusting nut, no spindle threads, no separate seal to fit!

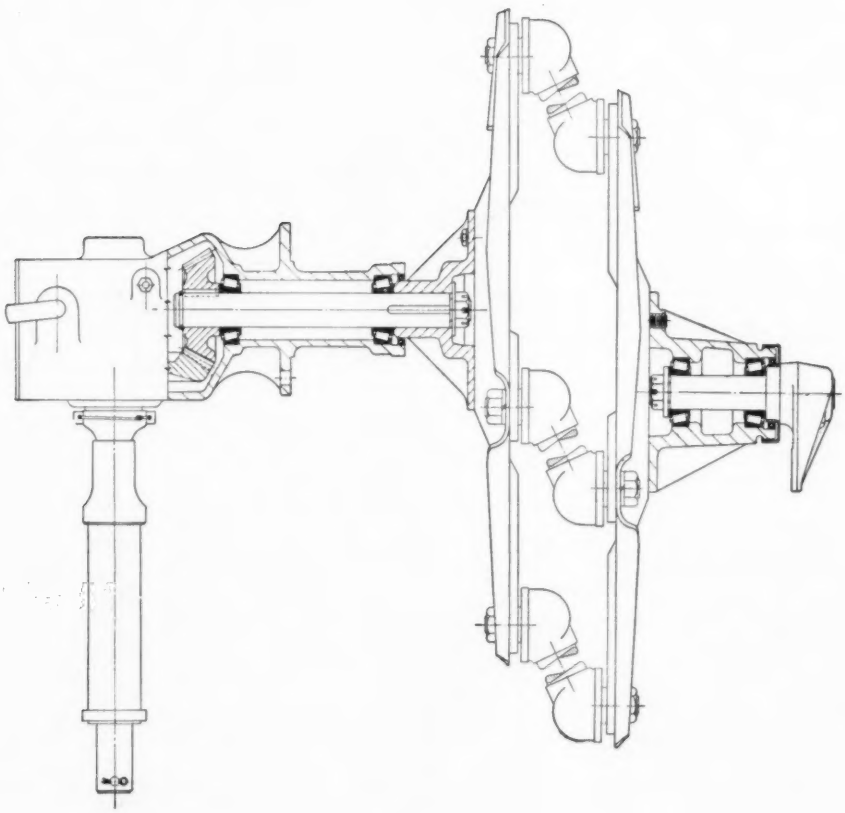
These New Departure ball bearings, thoroughly proved in high-production automotive wheels and other applications, are pressed in the hub. The hub is slipped over the spindle and retained by a snap ring—*fast, economical, simple!*

You'll find your New Departure Sales Engineer will gladly give you complete details.

ND NEW DEPARTURE
DIVISION OF GENERAL MOTORS, BRISTOL, CONN.
NOTHING ROLLS LIKE A BALL

For more facts circle No. 50 on reply card

How New Holland gets accurate alignment in hay rake reel



TO keep reel centers of their Model 55 Rolabar hay rake in accurate alignment under severe operating conditions, New Holland engineers mounted both ends of the reel shaft on Timken® tapered roller bearings. And by using popular high-production size Timken bearings, they also gained functional design.

Because Timken bearings are tapered, they take both radial and thrust loads in any combination. Full line contact between rollers and races gives Timken bearings extra load-carrying capacity. And by keeping housings and shafts concentric, they make closures more effective. Dirt and moisture stay out. Lubricant stays in. One lubrication a season is usually enough.

With Timken bearings, agricultural engineers find ready answers to three of their biggest problems: 1) combination loads; 2) dirt; 3) ease of operation. Timken bearings help farm machines perform better, last longer. We even make our own steel to insure finest bearing quality. We're America's only bearing manufacturer that does.

Field Engineering Service. Timken Company Field Engineers will gladly check your farm machine design and application drawings with you. They'll recommend the Timken bearings that will give you the best economy and performance. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable: "TIMROSCO".

The farmer's assurance of better design

Tapered Roller TIMKEN BEARING EQUIPPED

See the next Timken Televent hour, "The Innocent Years" over NBC-TV, Thursday night, November 21st.

NOT JUST A BALL ◯ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ▯ AND THRUST —▯— LOADS OR ANY COMBINATION

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